

THE JOURNAL OF MENTAL SCIENCE

(THE BRITISH JOURNAL OF PSYCHIATRY)



BY AUTHORITY OF
THE ROYAL MEDICO-PSYCHOLOGICAL ASSOCIATION

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“ In adopting our title of the *Journal of Mental Science*, published by authority of the *Medico-Psychological Association*, we profess that we cultivate in our pages mental science of a particular kind, namely, such mental science as appertains to medical men who are engaged in the treatment of the insane. But it has been objected that the term mental science is inapplicable, and that the term mental physiology or mental pathology, or psychology, or psychiatry (a term much affected by our German brethren), would have been more correct and appropriate ; and that, moreover, we do not deal in mental science, which is properly the sphere of the aspiring metaphysical intellect. If mental science is strictly synonymous with metaphysics, these objections are certainly valid ; for although we do not eschew metaphysical discussion, the aim of this JOURNAL is certainly bent upon more attainable objects than the pursuit of those recondite inquiries which have occupied the most ambitious intellects from the time of Plato to the present, with so much labour and so little result. But while we admit that metaphysics may be called one department of mental science, we maintain that mental physiology and mental pathology are also mental science under a different aspect. While metaphysics may be called speculative mental science, mental physiology and pathology, with their vast range of inquiry into insanity, education, crime, and all things which tend to preserve mental health, or to produce mental disease, are not less questions of mental science in its practical, that is in its sociological point of view. If it were not unjust to high mathematics to compare it in any way with abstruse metaphysics, it would illustrate our meaning to say that our practical mental science would fairly bear the same relation to the mental science of the metaphysicians as applied mathematics bears to the pure science. In both instances the aim of the pure science is the attainment of abstract truth ; its utility, however, frequently going no further than to serve as a gymnasium for the intellect. In both instances the mixed science aims at, and, to a certain extent, attains immediate practical results of the greatest utility to the welfare of mankind ; we therefore maintain that our JOURNAL is not inaptly called the *Journal of Mental Science*, although the science may only attempt to deal with sociological and medical inquiries, relating either to the preservation of the health of the mind or to the amelioration or cure of its diseases ; and although not soaring to the height of abstruse metaphysics, we only aim at such metaphysical knowledge as may be available to our purposes, as the mechanic uses the formularies of mathematics. This is our view of the kind of mental science which physicians engaged in the grave responsibility of caring for the mental health of their fellow-men may, in all modesty, pretend to cultivate ; and while we cannot doubt that all additions to our certain knowledge in the speculative department of the science will be great gain, the necessity of duty and of danger must ever compel us to pursue that knowledge which is to be obtained in the practical departments of science with the earnestness of real workmen. The captain of a ship would be none the worse for being well acquainted with the higher branches of astronomical science, but it is the practical part of that science as it is applicable to navigation which he is compelled to study.”—Sir J. C. Bucknill, M.D., F.R.S. (*Journ. Ment. Sci.*, vol. vii, 1861, p. 137).

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Part I.—Original Articles.

THE PRESIDENTIAL ADDRESS.

“The Past and the Future.”

DELIVERED AT THE ONE HUNDRED AND NINTH ANNUAL MEETING OF THE ASSOCIATION ON WEDNESDAY, 12 JULY, 1950.

By K. K. DRURY, M.C., B.A., M.D., B.Ch., D.P.M.,

Medical Superintendent, Carlton Hayes Hospital, Narborough, Leicester.

THE first and truly pleasurable task of a newly elected President of this old and honourable Association is to thank the members for election, and that I now hasten to do ; also for the numerous and kind expressions of congratulation and support I have already received.

My life in the Association and connected with it has been one of unexpected shifts and new experiences. In 1914 the late Alfred Miller, then your Registrar, informed me I was his deputy-assistant-acting-unpaid-secretary. The duties consisted in writing out thousands of names of entries to the examinations for the nursing certificates in a large book and later adding the results against each name. Luckily the 1914-18 war cut short this activity, and I found the duties of a regimental medical officer much safer and quieter than the bustle of an Association examination under Miller. The experience, however, gave me quite an understanding of the work the Registrar undertakes so willingly for the Association, and if nothing else it taught me the names and situations of the mental hospitals. Alas ! all the former are now changed and I have to try and learn them again.

My next experience was to be informed by the late Dr. Lord that I was a member of the Clinical Psychiatry Committee and later of the Education Committee—why or how I was left to imagine, but that is the way this unpredictable Association works. Obey orders first and find the reason—if any—later.

At the Folkestone meeting in 1936 I was informed that as there was no one else I was there and then made Secretary to the Education Committee, Dr. Masefield being called to higher things. Nine happy years followed, with

diverse and intriguing duties carried out under the Chairmanship of Dr. Petrie.

The gestation periods for some of the items of the Education Committee's agenda are certainly long enough, though others are commendably short. The new edition of the "Red Handbook" was agreed upon at Ayr in 1937, and though the happy event is expected at any time now, the period of waiting has certainly been rather extended. Dr. Dax is assuredly to be congratulated on handing over to the Specialist Consultant Obstetrician Editor a complete infant ready to be cast on an expectant Association. The twin—the "Green Handbook"—is, however, only as yet a pious endeavour.

Five years ago at Birmingham I was sent for by that powerful and autocratic body, the Nominations Committee, told to sit down and take notes as I was to be the new General Secretary. Someone was humming that old refrain "I will give you the Keys of Heaven" and I tried the answer "Oh! no John, no John, no John no!", but without avail. The Petrie-Masefield combination was irresistible.

The duties of the General Secretary are the most absorbingly interesting of all the Association's honorary jobs. Everyone is so helpful, the interests are so varied and the problems are so worth tackling that the whole atmosphere is stimulating. The work has increased from year to year, and the upheaval of the new Health Service has put new burdens on the Association. I should like here to say how much we all owe to the hard-working, efficient and ever cheerful secretaries at Chandos Street, without whose aid the Association would soon find themselves in Queer Street.

The great thing about being a Secretary is to do exactly as you want to do and make your Chairman believe that all suggestions are of his begetting. This works well with all but the Scots, who have the most unfortunate way of arguing about even their own ideas, not to say those of the Secretary.

That there can be no pleasure without pain, however, is an axiom well known, and the pain to me is to know how and on what subject to base this address. This difficulty is one that has obsessed every President I have known.

At least they have said so! And this is the 22nd consecutive annual meeting I have attended. All, I am sure, have consulted the volumes of the *Journal*, though few have admitted the fact. Dr. Helen Boyle is the last I have found who openly admitted having done so; my admission, therefore, that I have found this fact is my admission of having tried to get an inspiration from others.

Most Presidents have illuminated their own pet subjects, some have been prolix, others brief, but all interesting and informative.

The longest address was probably that of the late Dr. Lord, who spent some two hours reading the first half, while the second half had to be held over for publication in the *Journal*.

The shortest was that of Dr. Leeper in Dublin in 1931; he decided that a reception at the beautiful grounds of Dean Swift's Foundation at Lucan on a summer's afternoon was preferable to any words of wisdom of his.

A reception in honour of the Association by the Sheffield Regional Hospital Board this afternoon is certainly a thing to be looked forward to and enjoyed, so that, even if I have to conform to custom and placate the Furies, I will not keep you long, nor will I be able to place on record any gems of wisdom or

profundities of research ; but I should like to wander over some events in the past years to see if we can get an outlook on the future.

The General Secretaryship makes the holder at times delve into the past history of the Association for precedents and rulings. In many ways the old *Journals* give sufficient information, but the minutes of the Council are the most informative, though in both one has to read between the lines with a background of knowledge or rather lack of knowledge of the time.

The annual meeting at Littlemore, Oxford, decided upon the production and publication of the *Journal of Mental Science*. This was in the year 1853. The subjects discussed in the early numbers, the ideas expressed by eminent men, the difficulties experienced by those engaged in hospitals appear to be of perennial interest.

Listen to the great reformer Lord Shaftesbury in 1855—

“ Nevertheless we entertain a confident opinion that if the labours of the medical gentlemen were carried out under more favourable circumstances their effects would be the greatly more successful.”

Or Churchill in the late war—“ Give us the tools . . .”

Compare these with the last edict of the Ministry—“ No more money for anything.”

I should like to make a note here of the spelling used in these early copies of the *Journal*. The spelling of many words such as “ honor ” and “ favorable ” must remind us that the American language is much more conservative than our own, and that there is a considerable use of idiom often thought modern, a survival of Elizabethan English.

That money or rather the lack of it is the root of all evil is nothing new, and was not confined to this country only. The report in 1853 of the Ohio Mental Hospital stated that there was so little money that the Medical Superintendent had to pledge his credit to buy food for his patients pending the decision of the General Assembly to raise money or no. At the same date the picture at The Retreat, Hartford, Connecticut, was the opposite. Dr. Burlingame's predecessor, Dr. Butler, was extending and making better provision in all departments, especially in ventilation, which appeared to be a burning question of the times. He was also inveighing against relatives who would remove half-cured patients—a curious preview of our present difficulties under the recast Section 72 and the vagaries of voluntary patients.

The early editors of the *Journal* were fierce and outspoken men. How long would they last nowadays when the mildest criticism evokes storms of abuse from all and sundry ?

Listen to these few extracts of remarks on the Commissioner's entries and the annual reports. At the North Riding Asylum, the birthplace of occupational therapy as we know it to-day with the accent on therapy, the remarks say that all patients are occupied all day even to the state of hard labour, and if they aren't then the “ Spencer ” or strait-jacket soon puts them on the right road ; but these were the early days, the days of vast building schemes when the local big-wigs rated their efficiency by the smallness of the maintenance rate against a background of capital expenditure.

Kent County also got a word in season for refusing any occupation to anyone except a few non-demented chronics !

The Commissioners came in for many a hard hit, though also for praise. They state in the Warwick report that the farm is being got into excellent state, but the editor reminds them that they failed to say that it was a tenacious clay of the poorest quality, and was bought by the County Justices from the Lord Lieutenant at an enormous price.

Also they say Worcester was free from epidemic disease, but the editor notes dryly that 8 patients died from Asiatic cholera and 4 from dysentery during the year.

Cholera and dysentery are the subjects for many papers and notes in those early days, and many and curious were the remedies used and advocated.

One paper advocated calomel gr. ii every quarter hour for 5 hours and then gr. ii every half hour for the next 12 to 15 hours. Heroic !

Shortage of water to the new building sites was remarked. The Editor caustically states that architects and committees must believe that the madness of insanity was closely allied to hydrophobia. Ventilation and heating were also subjects for debate. It is curious to recollect that even 40 years ago most mental hospitals had a definite smell noticeable to all who visited them. Nowadays either our sense of smell is diminished and atrophied or else the "asylum smell" has vanished. I believe it is the latter, and that the freedom and lack of restraint is the cause as well as better sanitation.

This freedom from restraint was the theme that above all was the subject of discussion and the basis of numerous papers. Though many of us to-day rank Hanwell as the pioneer of freedom, it was in fact Gardner Hill at Lincoln who was the pioneer, but Conolly's writings and publications disseminated the idea far and wide.

The restraint chairs, we read, were used to floor the carpenter's shop at Hanwell and to make picture frames at Lancaster—the Editor liked the latter idea best, though he did not miss the symbolic "treading underfoot" of Conolly.

The Editor deplored the absence of escapes as evidence of restraint and applauded those hospitals where escapes were numerous.

Yes ! The early editors were great men with flails and scorpions in their hands. The Chaplain at Ayr in 1878—let me quote the *Journal*—"There is a chaplain's report . . . In it the reverend gentleman informs the no doubt grateful Board that he has enjoyed good health during the past year, and after a few uninteresting remarks indulges in some unctuous flattering of the officials."

The early journals, however, were not altogether taken up with caustic remarks, ventilation and dysentery, for the philosophic ideas of the time were widely discussed, and here I include a long article on the correct type of head-dress for male patients.

Dr. Lindsay at Crichton Royal wrote on the introduction of aesthetic elements into psychology, and the attempting by music and pageantry what formerly squalor, silence and darkness were left to accomplish.

Dr. Noble, lecturer on psychology at the Manchester School, defined insanity as an "apyrexial condition of the brain perverting thought and feeling to the destruction or impairment of moral liberty."

It appears that many were covering up in extravagant terms their lack of knowledge, but the striving was there, the effort to win through that is now but slowly coming to fruition.

The Editor was not wholly pleased with the language used, and in a review states that Dr. Pliny Earl of New York makes his book "an attempt to write fine—to soar above the vulgar jog-trot of English prose, to astonish the reader by airy flights of rhetoric and by brilliant conceptions with poetry"; the modern counterpart is a dull dog compared with either Dr. Earl or the Editor.

Those who are now concerned in the subject of abreaction would do well to read the journals, especially the French ones, for the years about 1853 to learn of the interest taken then in stigmatics.

Another subject was metalloscopy and metallotherapy in hysteria—worthy to be read by our modern E.E.G. addicts.

In 1850 the disease of general paralysis of the insane had only been known and described a comparatively few years. In the period 1850 to 1900 paper after paper appeared on the subject. It is easy with our modern knowledge of the disease to laugh at the attempts of our forefathers at describing the disease, but it was a very real entity to them and a serious menace, though it is now relatively seldom seen. An average death-rate of, in England and Wales, 1,382 out of a resident average of 75,903 for the years 1895-98 must be an eye-opener to the younger physicians.

In 1881 the presence of a syphilitic history in nearly every case of locomotor ataxia struck Gowers as most significant, and many observers classified G.P.I. into "syphilitic" and "true."

Koch discovered the bacillus of tuberculosis in 1882, and immediately isolation wards and verandahs were strongly advocated by such leaders as Crichton Brown, Broadbent and Clifford Allbutt. Cheap wooden buildings of combustible materials to be burnt down every few years was thought to be a good solution of the problem. What temporary building in England has ever been burnt down or even knocked down!

The Editor of the *Journal* in 1899 remarks anent the official obscurity on the history of tuberculosis in asylums during the previous fifty years, and says many of the useless statistical tables to be prepared could be scrapped in favour of a few useful ones, e.g. one giving the incidence of tuberculosis.

In short, the first fifty years of our *Journal* record the great move forward that Psychiatry in particular and medicine in general were making.

A groping after truth; a flash here and there of a cause; fierce endeavour to ascertain facts and elucidate the darkness; the study of the philosophy of life; new and better buildings; better sanitation and hygienic measures; freedom for patients; freedom for doctors to think and work—all were noted and placed on record as milestones and direction posts for others. Many were the advances made—many a thing done and forgotten, only to be hailed as new in the present day. Who does not think of shock therapy as new?

In 1880 a girl was bound by ropes and towed out to sea behind a fast row-boat so as to calm her manic state. Result—exhaustion, pneumonia, cure! Where were such advances made, you say? In Ireland, of course.

After-care and visits by trained personnel were advocated, and all must

remember that the Mental After-Care Association was formed in June, 1879, mostly as the result of a Presidential Address to the Association.

Here may I remark that the Association was urged to design their annual meeting on the American style with at least a week of celebrations and events, giving, perchance, the old Metropolitan Asylums Board's medical officers the opportunity to spend the 2s. Xmas Box that splendid body presented to all their domestics, laundry, kitchen workers and medical staff below the rank of Medical Superintendent.

The present activities of the Royal Commission on Capital Punishment remind us that the Association was actively engaged in the subject of criminal responsibility nearly every year in those far-off days. Hack Tuke wrote forcibly on the so-called mental experts in 1880. In 1886 the Association called for a Royal Commission. The McNaghten Rules were formulated, and it is interesting to note that the words "insane delusion" were deliberately used to make a distinction between the popular and the scientific sense of the words—popular meaning merely a mistake, whilst scientific was used to describe insanity or disease of the brain.

The younger generation and even the not-so-young can have little idea of the alcoholic state of the population any night in a large city. The effects of alcohol on the incidence of insanity was a commonplace in the days gone by. Liverpool stated that high range of employment led to high level of drinking and incidence of insanity and vice versa—the *Journal* was not convinced.

The United States are said by Dr. Jellinek, the biometrist, to have at least four million alcoholics to-day. That is those whom alcohol has robbed of their heritage of normality. I would ask you to read about that great psychological experiment undertaken by A.A.—Alcoholics Anonymous—and the outstanding work done by them.

A word or so more about buildings—that subject which preoccupied so many of our leaders in the last 50 years of the nineteenth century.

Towards the close of the century the villa system was considered and thought worth a trial, but most people forgot that the first asylum built on that principle was in Jamaica at Kingston as early as 1847 and that it was a complete success.

Ideas which are to-day only half-formed were put forward for acute treatment centres, with the necessary space in the vicinity for the chronic cases, but our forefathers echoed our lament—if that is a possible feat—of the undesirability, noted as far back as 1855, of admitting the senile and idiot to clutter up the hospital.

The 1886 Presidential Address was very strong on both these points, and Lockhart Robertson was all for the villa system with villas for the acutely ill.

T. S. Clouston designed a building for Massachusetts, but the plans were no real advance on what had been built already, and contained none of the ideals advocated by Lockhart Robertson.

Whilst travelling abroad members usually visited the mental hospitals, writing reports on their return for the *Journal*, and most interesting reading they make. I think that those who go on our Study Tours could write longer and better

reports than is done now, giving us who perforce have to remain at home the benefit of their advice and views on treatment and construction.

Ventilation, heating and outside appearance counted most, whilst interior arrangement appeared to count for little except in general terms. Ventilation I have referred to. Heating caused much trouble, and some Medical Superintendents refused to use the architect's pet system, much to his disgust no doubt, and relied on open fires. How many architects ever supplied space to store coal in a ward, not to speak of sufficient cupboards for ward use or space for patients' personal belongings, or side rooms for treatment and investigation?

Outside appearance counted for much; Brentwood's "Mediaeval appearance in the Tudor style" called for Editorial praise.

That the Stafford Mental Hospital was out of date in 1850 was noted by the Commissioners, who stated it was about to be pulled down. Like a poor relation it is still with us, but rumours of its removal still circulate! Manchester and Nottingham were bolder than Stafford and did demolish the old buildings and erect new ones.

The Commissioners had an eye for beauty and described the Killarney Asylum in glowing terms, one of the best and most beautifully situated and one of the best run.

One other matter was noted that has a definite bearing to-day. The value of the Annual Reports of the various hospitals and the Commissioners' entries was stressed in many quarters. What of to-day? Is the Minister afraid so that he discourages these reports, and gives so meagre a few pages devoted to Mental Health in the Annual Report of the Ministry? Not that all reports were of the same value. That for the Leicestershire and Rutland Asylum was a "handsome pamphlet," but was noted for its complete absence of information! The tour, a few years ago, of the Commissioners was easily plotted on a map by entries regarding the presence or absence of—canaries! Other birds or their absence did not count. Probably there was some deep psychological significance in this!

Nomenclature of disease for purposes of classification and statistical tables caused concern and many views were put forward. Signs, symptoms and sins of every imaginable type singly and in combination were tried, only to be discarded as knowledge grew.

It appears to me that we have got back now to much the same position with our new and unexpected, expensive statistical white elephant—or should I say pink?

The effort made by the Association in the early 30's of this century was far more scientific, concise and accurate, and was received and approved by the Board of Control; not used by them, however, for unhappily, as occurs so often in England, the views of foreigners must have precedence.

If I have spent so long over my first half-century of years I will endeavour to hit up the runs for the second half at a better rate of scoring.

The last fifty years and especially the last twenty-five have seen such tremendous strides forward in the line of treatment and research that it is too close and not in focus yet for evaluation in every respect.

all In fifty years this country has been involved in large-scale war on three occasions. There is no doubt that the upsets of war stimulate thought and output. It is hard to remember that in the South African war more of our troops died of enteric diseases than were killed in battle. Almroth Wright will always be known as one of the fathers of the modern curative and preventive era. Though there is much more to do, the change in safety to life to-day from these diseases is remarkable.

all The spirochaetal cause of general paralysis and tabes has revolutionized our ideas and malarial treatment our results. It will take time, however, to evaluate the treatment of the acute stage of V.D. infection on the tertiary manifestations in terms of the rise and fall of virulence of the elusive spirochaete.

Alone, these two advances in the grip of medicine on intestinal and syphilitic diseases would have given the future historian sufficient cause for thought.

all Who will and when see through the fog of enthusiasm that surrounds at present insulin, electro-shock and leucotomy treatments, all in their various phases, types and combinations?

Any new type of treatment is like an ampelopsis, that plant that grows by suction; first year the tender shoots, next year a fine show of growth, and next year all over the damn place!

It must be the duty of the Association to view and review every type of treatment so that an unbiased, critical but withal kindly eye—void of fear on the one hand or favour on the other—can present the results to the world. Thank goodness our members have that scientific outlook that is glad to have the preliminary results and conclusions of the few placed before the many, well knowing that no progress can be made unless there is critical study by colleagues at home as well as abroad. We must always be on guard against excess.

all Our good friend from Hartford, Connecticut, said to me not long ago that one could not walk down the Harley Street of New York and emerge at the far end with one's frontal lobes intact.

Further to this point may I draw your attention, if that be not presumptuous, to the fourth leader in *The Times* as a daily delight and inspiration, especially to a President-Elect in search of material for an address! Let me quote part of the leader which referred to the unfortunate death of Lord Mildmay a short time ago. It is headed "Gentleman Rider," and proceeds:

all "As a nation the British have always owed both their survival as such and the projection of their spirit into a wider sphere to a capacity for taking risks; and it is perhaps an almost tribal instinct among them to feel a peculiar affection for those who exhibit this capacity at its best. The man who plays always for safety is only a little less revered by them than the man who does not play unless he feels confident of victory. By the daredevil they are interested rather than impressed, for they distrust stunts; those whom, in whatever field, they honour most highly as sportsmen are generally men who combine the skill and authority of the professional with the pluck and insouciance of the amateur."

all Wise words to our own daredevils, and an inspiration to the well-trained, thoughtful worker.

As I am on the subject of fourth leaders, may I mention another starting "A penny for your thoughts" and say something about the present crisis in our affairs?

The mental hospitals have had, for well over a hundred years, a reasonably standard system of accounts, and could with accuracy forecast their budget demands, giving costs under many headings to decimal points of a penny.

Those who read the back copies of the *Journal* will find many references to these costs, and the published annual reports give the detail. To say the least it is unfortunate that just when we are going ahead with curative treatment as distinct from custodial care this very accuracy of estimating should endanger our progress.

We are in the position that Mr. Micawber found himself—misery instead of happiness for a mere sixpence in the pound deficit in his accounts.

I believe we cannot refuse to accept certified patients. To cut down expenses temporarily by refusing voluntary patients is to commit suicide. Our hospitals in general are understaffed, and where large savings are to be made without disaster is hard to see.

We can only hope that the Regional Hospital Boards and the Ministry will well examine the accounts of their mental hospitals and colonies for the years past and take the statesmanlike course of restoring the cuts, when they observe the meticulous care and scrupulous desire for economy with efficiency characteristic of the Committees of Visitors and continued by their successors. Mr. Bevan acknowledged this fact in the House of Commons, and held up the efficiency in value for money of the Mental Health world as a point for others to emulate.

That large sums are required for capital works is obvious to all. New hospitals are required for the growing population. Most urgent of all is the need of accommodation for the mental defective in our midst.

There are many thousands—I believe tens of thousands—of mental defectives, who on expert advice require institutional care, and are surely entitled to it under the widespread umbrella of the National Health Service.

The reaction on the parents and family of the low grade defective can only be gauged by those who have to come in contact with the problem, and it is often disastrous. No less deserving of the earliest care are the higher grades, who are the cat's paws of the younger hooligans who cause so much social mischief. I am firmly of the belief that the removal of the defective from the streets would do much to solve the delinquency problem.

The training and supervision given in good colonies to these defectives, in many cases fits them later to give a useful and adequate return to the community for the cost originally expended on their training. On the ethical side I need not touch, nor do I wish to enlarge further on the subject of delinquency, which to-morrow will be discussed in all its aspects by those eminent in the branch and eloquent in words.

At the present date there are in the Sheffield Regional Hospital Board area no less than 655 defectives for whom places are being actively sought; in addition to this there are over 3,000 cases notified and known for whom institutional care should be provided. I must state here that the Minister in the

House in June this year stated that there were 5,316 defectives awaiting admission, but he did not state the number of known defectives for whom institutional care was both necessary and desirable.

The Sheffield Board, to their eternal credit, put up to the Minister in the strongest terms the need for a million pounds to build or expand colonies in their area. One can only tear one's scanty hair and cry—"How long, Oh Lord!, how long?" and compare the lost millions in African groundnuts to the inestimable benefit that even one million would bestow on the M.D. situation.

There are many and urgent problems facing the Association in the immediate years to come, apart from the present financial state, and, though finance is bound up with progress, we need not hesitate to make our plans.

Amongst them I will mention only a few of the more urgent and pressing :

The recruitment and training of our medical staffs ; the number and types required in the new dispensation where every ensign not only has a Field Marshal's baton in his knapsack but is promised its emergence at the age of 32 ; the recruitment and training of our nurses and other medical auxiliaries ; the role of the acute hospital and the out-patient treatment centres—treatment centres that afford a proper accommodation for patient, doctor, nurse and P.S.W., with space for rest after treatment. These will reduce the volume of patients being admitted to hospital, admitted only too often because out-patient facilities are lacking ; the provision for the aged ; the proper way to care for those cases referred to us under the Criminal Justice Act (it may be noted that the French Government in the 1850's placed all cases charged with crimes carrying capital punishment in the observation ward of the hospital at Maréville so that the Director, Dr. Morel, could advise the Court) ; the question of medical administration in our hospitals and colonies ; the very position of our own Association as the arbiter of psychological progress and thought ; cybernetics—that completely engrossing subject ; the E.E.G. ; atomic substances ; the question of the comic-strip in the newspapers that is fast making a world of make-believe for youth, especially in America, and with so many exhibiting a sadistic streak that surely can do no good ; the suitability of certain films for public showing, also of broadcast talks and discussions.

These and many other topics will require our united thought and understanding.

We must fit ourselves to be able and willing to co-operate with others to devise and plan prevention of mental trouble. A population "*Integer vitae scelerisque purus*," freely translated to read "Well integrated morally and in no need of psychoanalysis" must be the aim.

To me there are two main avenues of approach to this goal ; a general return from the post-war restlessness and feeling that everyone is out of step except our Jimmy. Second, by an abolition of these cursed controls and orders that stifle everyone, especially the would-be housewife, combined with the supply of an adequate number of good houses. Given these latter I feel that my first premise will be met and there will be a vast decrease in the psycho-neurotic population.

To have dwelt somewhat in the past needs no excuse if we are to try and

forecast and plan the future. I would ask those who can to study our past history in the *Journal* and elsewhere. I would say, somewhat in the words of the Bible, "Put on the whole armour of God"—in other words, try and be the whole physician and not the sub-specialist. The whole patient is given to our care, and not only the mind, wherever that may be situated. Study whatever influences may exert their beneficial or harmful effects on it, both internal and external, and strive forward.

There is ample to strive for, worth striving for. We have many millions of years to go before we join Kipling when he wrote :

" When Earth's last picture is painted
and the tubes are twisted and dried ;
And the oldest colours have faded,
and the youngest critic has died ;
We shall rest, and faith ! we shall need it ! "

As long as we live there is hope, and hope is always a target to aim at.

I am finished, but to quote a then Duke of Gloucester—"Another damned thick square book ! Always scribble, scribble, scribble—eh ? Mr. Gibbon ! "

FRONTAL LOBE FUNCTION AND THE AFRICAN.

By J. C. CAROTHERS, M.B., D.P.M.

INTRODUCTION.

IN a previous article—"A Study of Mental Derangement in Africans"—the writer described primitive African culture, thinking and attitude to life, and the types of mental derangement seen in Kenya over a 5-year period, and endeavoured to explain the peculiarities in the incidence and nature of African mental derangement on the basis of cultural factors.

The present article, though complete in itself, is in some ways a development of the earlier one, and arose out of a request by the Kenya Director of Laboratory Services for tests of character which would help him to select *reliable* Africans for work in the Laboratory.

In the course of the investigations that were made as a preliminary to the production of suitable tests certain facts emerged which forced the writer's attention to a striking resemblance between African thinking and that of leucotomized Europeans.

The writer was therefore led to make certain deductions about the neurophysiological basis of African thinking and character, and about the functions of the frontal lobes in general, and to attempt an explanation of the peculiarities of African mental derangement on the basis of these deductions.

The article therefore falls into eight parts as follows:

1. A description of primitive African culture, thinking and attitude to life which is in effect a summary of part of the earlier article. This part is required as a basis of reference and explanation for the later parts of the article and, with a view to carrying greater conviction, it contains much direct quotation from other writers.

2. A description of the more striking peculiarities of mental derangement in the African. This again is largely a summary of the earlier article, but with modifications resulting from a further 5 years' experience.

3. A description of the preliminary investigations for the production of tests of reliability, and the writer's deductions about African thinking that arose from this investigation and from the facts recorded in Parts 1 and 2. (The subsequent test production and application is irrelevant to the present theme and is not described.)

4. A description of the effects of leucotomy on European personality in general.

5. An assessment of the resemblance between the African and the leucotomized European, and the writer's deductions from this.

6. An attempt to apply the deductions in Part 5 to the peculiarities described in Part 2.

7. A general discussion and conclusion.

I. AFRICAN CULTURE, THINKING, AND ATTITUDE TO LIFE.

No doubt cultures develop out of the needs of societies, but it is equally true that the peculiarities of thinking and attitude seen in living individuals are largely determined by the particular culture in which they live. So the relevant features of African culture are first described.

(a) *Cultural Factors.*

The primitive African is governed by a large, complex and rigid social organization, based on a wide extension of the family system, and by which a high degree of security for the individual is achieved in face of the manifold hazards of nature. There is a place for everyone within this system and widows and orphans, for example, are never outcast or destitute.

This organization implies and demands the observance of meticulous rules and restraints in regard to manners and behaviour in all departments and at each stage of life and, in Kenyatta's words, "In all tribal education the emphasis lies on a particular act of behaviour in a concrete situation." These rules, though unwritten, are so well known that any infringement implies, and is recognized as having, an unsocial motive. There is no room for free thought nor for misfits, and even secretive, solitary or outstandingly successful people are suspect.

Everyone sooner or later knows the whole culture of the group, there is little specialization and a great equality of knowledge. Status depends on age rather than on intellect, knowledge or achievement and, since actual ages are unknown, on certain landmarks, especially puberty and marriage. Occupations and rules of conduct are strictly arranged according to these landmarks, and the African constantly acquires more rights and duties in an ever-widening field as the social organism of which he is an essential part increases in size with each rise in status.

All primitive Africans are closely attached to particular areas of land; all customs, culture, religion and myths refer to particular localities which are the visible symbols of clan kinship and nurse the ancestral spirits. The rules of behaviour have little or no application outside the limits of the group and tribe or of the tribal land, for there is no general abstract code.

Since each man is heir to the whole knowledge of his group, he is also aware of the limitations of that knowledge and feels a great consciousness of ignorance and awe of the unknown. He recognizes higher powers—higher than the ancestral spirits—who must at times be supplicated and, in Driberg's words, "Every activity has its religious background and sanction, and it would be quite impossible to divorce their religious beliefs from their everyday practices without completely destroying the basis of their society." There is, however, little link between ethics and religion and, as Westermann says, "The gods and ancestors take but a slight interest in the ethical behaviour of their worshippers and are almost indifferent as to the inner attitude in which they are approached. What they demand is offerings and invocations. . . . Ethics, in the sense of civic virtues, are rooted in the traditional rules regulating the behaviour in social groups." Both ethics and religion apply, moreover, only

within the group, and the gods can only be supplicated by the group—not by a lone individual. There is thus no conception of universal truth and justice, or of right and wrong in any general sense and, in Raum's words, "The child becomes conditioned to a morality whose demands become less stringent the remoter they are from the 'initial situation' of the family."

African culture fails to recognize the intrinsic nature of cause and effect and, again to quote Westermann, "The African has never progressed so far as the knowledge of true causal connections or natural laws. He possesses a certain amount of knowledge of nature . . . but for the greater part it is pseudo-science, knowledge mixed with a child-like play of the imagination. . . . The idea of an event happening from an inner natural necessity is difficult for him to grasp. . . . Behind an occurrence there is for him not so much a cause as one who causes. If a tree or a human being dies, then someone, be it a spirit or a person or a 'power,' has made him die. For inner necessity or natural causes a 'personal' will is substituted."

It is also important to record the almost complete absence of children's toys and of any form of visual symbolism, especially of the written word, in primitive East African culture—facts which probably have important influences on African thinking, as will be shown later.

(b) *Thinking and Attitude.*

This section is in the main a summary of the previous article and is inserted because that article was written without any relation to the present theme of frontal lobe function, and may from that point of view therefore be regarded as an unprejudiced basis of reference.

One cannot do better than start with a series of quotations from Westermann, taken from that article, and which run as follows :

"With the Negro emotional, momentary and explosive thinking predominates . . . dependence on excitement, on external influences and stimuli, is a characteristic sign of primitive mentality. Primitive man's energy is unstable and spasmodic. He is easily fired with enthusiasm for an undertaking and begins his work with great zest ; but his interest dies down quickly and the work is abandoned. . . . Where the stimulus of emotion is lacking the Negro shows little spontaneity and is passive. He waits for what is coming to him and evades what is inconvenient, or adapts himself to it, instead of bravely confronting the obstacles of life and mastering them. . . . The Negro has but few gifts for work which aims at a distant goal and requires tenacity, independence, and foresight."

"The interest which the African takes in things is not an academic one. They concern him in so far as they are useful to him or can do him harm . . . observation is often superficial ; conclusions have been drawn from it in a most uncritical way ; and instead of further thought on the matter, word spinning has seemed sufficient . . . knowledge mixed with a child-like play of the imagination."

"The world of the primitive African is characterized by its unity and coherence. No sharply defined aspect exists by itself ; wish and reality, the

possible and the impossible, knowledge and belief, thought and imagination, the realms of secular and religious life are interwoven and fundamentally one."

"The consciousness of being an organic and well-protected member of a group gives the individual a definite self-consciousness and dignity . . . he is not easily embarrassed. Within his own circle he is never in a position where he does not know how to behave or what to do . . . work is not specialized in the same way as with us and therefore the non-expert 'layman' . . . does not exist. The African is able to enlarge with ease on any subject . . . he does not suffer from social disabilities, for there is hardly any economic dependence, nor is there a distinction between servant and master, rich and poor. Hence nobody suffers from an inferiority complex. . . . It is natural for him to express his real personality, for everybody knows everybody else, and no one can therefore permanently conceal his nature." (Westermann is presumably using the word "self-consciousness" in this paragraph in the sense of social self-confidence—certainly not in the sense of shyness as may be seen by the context, and presumably not in the sense of self-understanding for which in fact the African has little ability or enthusiasm).

"A man does not plan, set himself an aim and exercise his strength in attaining it. The individual as such has no aim in life if his task is to become exactly like the rest. . . . The motives for his actions are predominantly social, not individual, and are deeply influenced by public opinion. . . . Personal responsibility is avoided wherever possible."

In general the primitive African is very close to nature and the realities of life and death. Disease and misfortune are familiar experiences and come unaccountably like bolts from the blue. He feels that what strength and stability he has comes from the fact that he is part of a larger organism, and that he can only preserve this modicum of power by playing most meticulously his special part in this organism. This attitude governs his whole life and results in extreme conformity to tradition, conservatism in thought and fear of innovation. In the absence of any general conception of the inherent nature of cause and effect, he regards the workings of fate as arbitrary and haphazard and, provided he has obeyed the traditional rules, he rarely blames himself for his failures and misfortunes, but is apt to attribute them to the anger of some external agency and believe himself bewitched. Since his rules of behaviour only apply within his group and in relation to his clan land, and since he has no general abstract codes, he is left without a guiding star when he leaves his reserve.

Finally, in the absence of children's toys and written language, the African is highly dependent for his amusement and his learning on the spoken word. This fact seems to the present writer to be of fundamental importance and its implications will be discussed in the conclusion of this article.

2. THE PECULIARITIES OF AFRICAN MENTAL DERANGEMENT.

The previous article included a study of mental derangement in Kenya Africans. This study was based on figures of persons certified insane and

admitted to Mathari Mental Hospital during the 5-year period from the beginning of 1939 to the end of 1943, and the figures so obtained were compared throughout with those for American Negroes and at times with those for Europeans.

The chief peculiarities that emerged from these comparisons can be briefly summarized as follows :

(a) There was probably a very low general incidence of insanity among Africans living in their natural environment. This was considered to be due to an absence of problems in the social, sexual and economic spheres.

(b) General paralysis was found to be rare in the indigenous population, and this was thought to support the theory that syphilis was a recent introduction to the interior of Kenya. It was also noticed that a large proportion of our cases were of the "expansive" type, and it was thought that this was probably because this type would be most unmanageable and most likely, therefore, to be certified as insane in a country where many insane are known to be looked after at home.

(c) Arteriosclerosis was found to be rare, and it was submitted that its rarity was entirely consistent with the primary importance of a mental attitude in its causation, at least in many cases.

(d) Paranoia was found to be comparatively rare, and to be associated, in at least 9 cases out of 11, with long-standing exogenous factors, namely prolonged sojourn in an alien or inimical environment. This type of environment rarely occurs in primitive society and in fact 6 of our 11 cases occurred in nomadic Somali traders and immigrant people.

(e) Manic-depressive insanity was found to be relatively uncommon and this was mainly accounted for by the absence of psychotic depression. It was observed that a large proportion of the manic cases had been holding responsible positions and appeared to possess an attitude of personal responsibility that is foreign to most Africans. It was surmised, to account for the absence of depression, that the repressing and inhibiting elements of the African's mind have been less exercised and are weaker than these elements in the European. It was considered in general that the attitudes expressed by manic-depressives, and which are usually regarded as secondary to any rationalizations of the mood change, really play a more basic part in the aetiology of the disease. This in turn gave rise to the suggestion that schizophrenia (in which very different attitudes obtain) and affective disorder might be viewed as developments of one basic hereditary tendency to mental instability, but diverging for mainly environmental reasons.

(f) It was considered that involutional melancholia, though atypical, occurred and that this condition fell into a separate class from the manic depressive psychosis proper. Ideas of guilt were consistently absent, though persecutory ideas occurred, and it was submitted that the delusions in *this* illness were secondary to the mood change and that they would be likely to be persecutory in the African for cultural reasons,

(g) A condition which the writer entitled "frenzied anxiety" was commonly seen and appeared to be very similar to "Amok" as seen in Malay. It was

considered that this condition arose out of the African's lack of self-criticism and sustained emotion, and that the common tendency to homicide arose (on hysterical lines) out of the general belief in a limited total amount of life force.

(h) Obsessional neuroses were never seen, and this was considered to be related to the absence of personally-developed codes of behaviour.

* * * *

A further 5 years' experience at Mathari Mental Hospital, subsequent to 1943, has supported most of these findings, but certain important modifications and additions must be made.

(A) The "expansive" type of general paralysis is undoubtedly relatively common. This point was touched upon in the previous article, but was not sufficiently emphasized.

Curran and Guttmann say the expansive or classical form, by which they mean "a demented euphoria and ideas or delusions of grandeur," is nowadays rare. Henderson and Gillespie say "a state of contented dementia . . . is the most common variety. . . . Grandiose delusions . . . are not so common as has been generally supposed." Russell Brain says that the simple dementing type is the commonest, the grandiose form (with euphoria and grandiose delusions) is less common, and other forms, e.g. depressive, occur; he says "the form taken by the mental disorder doubtless depends upon the patient's constitution."

At Mathari Hospital 35 African cases of general paralysis were seen during the 10-year period. Of these cases, 26 were expansive (with euphoria and grandiose ideas or delusions), 5 were empty of mood, and 4 were somewhat depressed. So the incidence of expansiveness was definitely high and doubtless much higher than in England. Moreover, the previous suggestion that expansive cases are the most unmanageable and therefore most likely to be admitted does not entirely meet the case, since more than a third of our paretics were immigrant Africans who live in townships and are *not* easily able to look after their insane relations, and of our immigrant paretics at least half were euphoric.

So it seems that our high proportion of expansive cases corresponds, at least in part, to a *really* high proportion of the paretic population—a problem which will be further discussed in part 6.

(B) In the previous article a relatively large proportion of admissions of psychopathic persons was recorded, and was explained by the fact that in a young Colony where many mentally abnormal persons are looked after at home these are just the sort of unmanageable cases that are apt to be sent to hospital. At another point in that article it was said that one might argue that *all* primitive Africans are psychopathic by European standards.

The whole question of the "psychopathy" of Africans requires enlargement at this point, more especially since the title has been used in so many senses by different writers that some, for example Kinberg, have even suggested discarding it altogether.

Although, however, there is clearly no general agreement at present as to

the precise application of the title, it is equally clear that few psychiatrists are prepared to discard it and Slater, for instance, says, "If we were to drop the term altogether, we should be obliged to invent an equivalent or to hamper ourselves in the description and categorization of a whole series of clinically very important phenomena." It is also clear that a large number of eccentric personalities, albeit not definitely psychotic or neurotic, can be fitted into well known psychiatric categories (e.g. schizoid, epileptoid, or hysterical personalities, etc.), but that, when this has been done as efficiently as possible, there still remains a large number of eccentric persons who require psychiatric titles since they constitute a fraction of the population for whom medical advice is frequently sought and sometimes given. This remaining group is not clinically homogeneous, but it *includes* a section of the population (variously entitled sociopaths, unstable psychopaths, inadequate persons, etc.) which has been described in such similar terms by so many authorities that it would seem perverse not to recognize its claim to a psychiatric category. Indeed, few writers have failed to do so, no matter how broad or narrow their concept of the title Psychopathy. No doubt many such persons are "moral defectives" but this title is inadequate for the present purpose since, as legally defined, it excludes some of the persons we are now considering. Not all psychopathic persons have "strongly vicious or criminal propensities"—indeed, this is probably true of only a small minority.

The following are examples of descriptions of the group we are considering. Cheney says—"Psychopathic personalities are characterized largely by emotional immaturity or childishness with marked defects of judgment and without evidence of learning by experience. They are prone to impulsive reactions without consideration of others, and to emotional instability with rapid swings from elation to depression, often apparently for trivial causes." Levine says—"The patients of this group do not have specific signs and symptoms of illness as do the neurotic and psychotic. Their disturbance is one of action and social behaviour. The essential patterns of the psychopath are these: They live predominantly in short-term values, i.e. have a predominant need for the immediate satisfaction of their impulses and desires, and are unable to subordinate immediate gratifications for more lasting pleasures. They tend to act out their conflicts in social life, instead of developing symptoms of conflict in themselves." Bullard says—"The commonly accepted conception of a psychopath is a person who cannot learn by experience, who fails to recognize the limiting or restraining influences of reality. Such a person recognizes no law but his own immediate need. . . . They are truly the social misfits. . . . They live in and for the moment, have a keen intuitive empathy which enables them to shift position rapidly, but they have no real alertness to or comprehension of the implications or complications resulting from their behaviour." Norwood East says—"It is characteristic of the different types of psychopathic personalities that they are unable to subordinate a short-term gratification to a long-term advantage." Curran and Guttman say—"The most prominent features are poverty of will-power and determination." Henderson and Gillespie say—"We include under this description (psychopathic states) persons who have been from childhood or early youth

habitually abnormal in their emotional reactions, but who do not reach, except episodically, a degree of abnormality amounting to certifiable insanity; they show no intellectual defect . . . and they do not benefit under prison treatment. They constitute a rebellious, individualistic group who fail to conform to their social milieu, and whose emotional instability is largely determined by a state of psychological immaturity which prevents them from adapting to reality and profiting from experience. They lack judgment, foresight and ordinary prudence." Curran and Mallinson have summarized Hall's criteria as "Egocentricity; inability to profit by experience; emotional instability; lack of perseverance; unreliability and irresponsibility; defective judgment; suspiciousness," and Sprague's criteria as "Inability to postpone; ineffective consideration of consequences; insufficient learning from experience; faulty synthesis; disproportionate responsiveness; affective dominance over intellect; disvaluation of reality; disregard for truth; insufficient social valuation."

Tredgold regards the title "psychopathic personality" as unnecessary and considers that such persons can be included in other psychiatric categories—notably that of moral defect. If, however, one eliminates from his description of moral defect the "strongly vicious or criminal propensities" required to fulfil the legal definition and which only applies to some cases, one finds his description accords very well with those of the other writers we have quoted. He says, referring to moral defectives, "In my opinion, the mental defect characteristic of this class is a twofold one, namely a defect of that complex quality which has been designated common sense or wisdom, plus a defect of moral sense. Now, as I have already stated, a person may be lacking in both wisdom and moral sense, and yet suffer from no scholastic ineducability, and no obvious incapacity to adapt himself in a seemingly intelligent manner to the requirements of the present moment. Far from being illiterate, he may have a good range of educational acquirements; he may be nimble-witted, a good conversationalist; plausible in argument, and able to give a good account of himself. In short, in his response to many tests, in appearance, manner, and conversation, he may be quite normal and totally different from the ordinary ament. And yet, in spite of all this, his lack of wisdom will cause him to be incapable of adapting himself in a satisfactory manner to his social environment; he will be unable to see actions in their true values, to form sound judgments, to take long views, to make prudent plans, to forego an immediate but transient gain for the sake of a greater and permanent advantage. In addition, his lack of moral sense will cause him to be incapable of experiencing any emotion regarding the rightness or wrongness of his acts; although he may be conceited, he will have no real feeling of self-respect and no sense of personal responsibility or social obligation; he will be incapable of experiencing any urge to moral endeavour and he will almost certainly be unable to control any selfish and anti-social impulses."

Admittedly these examples are selected, but they are complete in themselves, and in such substantial agreement with each other that it is possible to summarize them in a very few words as will be done below. Moreover, a picture emerges which is clear and very familiar to psychiatrists who have any dealings with social misfits.

Though little can be said at present about aetiology or treatment, it seems therefore to the present writer that there does exist in European psychiatric practice a very large group of persons who show certain well-defined characteristics and therefore, for clinical purposes, deserve a psychiatric title—be it psychopath, sociopath or some other. The definition of this title as it is proposed to use it, and as summarized from the quoted descriptions, would run as follows: "These are persons who live in a perpetual here-now and lack the desire or ability to control their passing emotions and so to subordinate immediate gratification to their own long-term interests." All the qualities listed in the above quotations are included in or implied by this definition.

Now, to turn to the African, and in regard especially to the African living at home in his reserve, it would seem at first sight that he does *not* fulfil the requirements of a psychopath. Far from "failing to conform to his social milieu," he conforms to it only too completely as has been shown. Nevertheless, in all other respects the resemblance is obvious, his behaviour is largely determined by his passing emotions, he *does* lack foresight, perseverance and sustained determination, he *does* evince a "keen intuitive empathy" and a corresponding "disregard for truth," his unreliability and irresponsibility are notorious from a European viewpoint, his ability to learn from experience and adapt to reality is very variable, and his lack of judgment and "faulty synthesis" become apparent in Part 3 of this article.

Since disturbance of social behaviour is one of the cardinal features of the European psychopath, one is led to a further consideration of social conformity in the African. The question as to whether the primitive African possesses a general "social sense" in our meaning of the phrase, however, is no sooner asked than answered—in the negative. Nothing will make him laugh more heartily than to see a blind man slip on a piece of banana, and the attendants of a condemned murderer are quite likely to jest crudely about his future in his presence. So long as the victim is not one of his relations or clansmen, to whom he must by rule be courteous, consideration for others is conspicuous by its absence.

Finally, episodes of antisocial violence, which are so apt to occur in European psychopaths of an aggressive type, find a close parallel in the syndrome we have previously described under the heading of "Frenzied Anxiety," which is a common form of mental disturbance in persons who appear, after the storm has passed, to be perfectly normal Africans.

So the resemblance between the mentality of the normal primitive African and a certain type of aberrant European mentality commonly included under the title psychopathic is found to be very close. When we come to the partially detribalized African the resemblance becomes even more striking. Since he is then left without his tribal rules of behaviour and has acquired no general abstract codes, this fact is hardly surprising. Indeed it is a matter for admiration that he so often makes good in the alien environment, a tribute to his *basic* adaptability, in which he more closely resembles the European child than the European adult psychopath.

(c) It was shown in the previous article that paranoia was relatively uncommon, especially among the races that were not pure Hamites, and that

when it did occur it was almost invariably related to unusual environmental factors, namely prolonged sojourn in an alien and inimical environment. It was also shown that, of a total of 174 schizophrenics (not including paranoia) only 11 (or 6.3 per cent.) were considered to be of the paranoid type. Subsequent experience has confirmed the former observation and also the general uncommonness of paranoid schizophrenia.

A further fact has emerged in regard to paranoid types of schizophrenia in general. In the previous article it was concluded to be impossible to assess the degree of education of an African in any exact and scientific manner. This conclusion still holds but, as a rough and ready substitute, the African interpreter of the hospital was requested to prepare a list of all those in-patients on a certain date (5 Jan., 1949) whom *he* considered to be fairly well educated on European lines. One has no reason to doubt that his assessment was as correct as such an assessment can be and it has the great advantage of being independent and unbiased.

All patients diagnosed as schizophrenic or paranoiac and in the hospital on that day were then independently classified in two groups—(a) those with a tendency to chronic delusions (persecutory or grandiose) and usually a fairly good preservation of the personality and (b) those with no such tendency and usually a marked disintegration of the personality. Group (a) includes those cases that are commonly called paranoid schizophrenia, paraphrenia and paranoia, and group (b) those called simple, hebephrenic and catatonic schizophrenia.

It was then found that among 119 non-educated cases only 15 (or 13 per cent.) were paranoid in type, whereas among 30 educated cases there were also 15 paranoid patients (or 50 per cent.). The difference is significant in a high degree, with a χ^2 figure of 21, and there seems no reason to doubt that paranoid types of schizophrenia rarely occur in Africans unless they have received some European education. An apparent exception to this rule, and which accounts for no less than 5 of our non-educated paranoid cases, is the high proportion of paranoids among immigrant and Somali patients (7 out of 17 cases), but in both these groups the patients had for long been living in townships and had for long been partly detribalized and it might well be argued that, although they had received little or no formal education, they had nevertheless acquired a type of sophistication that was its equivalent.

(D) In regard to affective disorder, five important modifications of our previous findings must be made.

(1) Mania is somewhat commoner than was previously stated, but many of the cases are far from classical. During the 5-year period 1939 to 1943, 23 cases were diagnosed as mania (or 3.8 per cent. of the total new admissions); whereas in the 5-year period 1944 to 1948, 55 cases were so diagnosed (or 6.1 per cent. of the total admissions). The excess is largely composed of persons who, though excited, restless, noisy and irritable, show little sustained elation, little tendency to develop grandiose schemes, and often show schizophrenic features especially bizarrely exaggerated movements and facial expressions.

(2) Fairly typical retarded depressions have now been seen (though ex-

ceptionally), and the sharp distinction that was made in the previous article between involuntional melancholia and other types of depression (on the lines of Henderson and Gillespie) can no longer be upheld.

Henderson and Gillespie believe that "there is a group of cases which we can term involuntional melancholia distinct from manic-depressive states" and in which the characteristic features are "depression without retardation, anxiety, a feeling of unreality and hypochondriacal or nihilistic delusions." They reserve the title for patients with such symptoms occurring at the involuntional period and who have never previously suffered from any form of mental illness.

In the 10-year period there have been seen only 24 cases definitely suffering from a depressive psychosis of any sort, or 1.6 per cent. of the total admissions. Even allowing for the fact that other cases have doubtless been missed on account of their atypicality, the condition as a whole is relatively rare.

None of the cases fulfilled all Henderson and Gillespie's requirements for involuntional melancholia but, allowing for the facts that "feelings of unreality" are difficult to elicit in Africans (who have little ability to analyse and express their feelings) and that persecutory delusions are a characteristic reaction in them, there were about 6 cases that might be classed as involuntional melancholia—occurring at the involuntional period, with agitation, and hypochondriacal or persecutory delusions. Of the remaining 18 cases, two were agitated depressions in persons aged 30 and 40 years, and 16 were retarded depressions occurring at all ages from 25 to 60 years and again mostly exhibiting hypochondriacal or persecutory delusions.

Admittedly there was a greater incidence of agitation at higher age levels, for the average age of retarded patients was 40 years and of agitated patients was 49 years but, since 5 of the retarded cases occurred about the involuntional period and one of the agitated at 30 years, no sharp distinction could be made in this series, and henceforward in this article all depressive psychoses will be classed together.

(3) There is no doubt that classical psychotic depression of any type is relatively rare in the African. Indeed if one confined the diagnosis to cases exhibiting the symptoms described in British text-books of psychiatry one would very seldom make the diagnosis. Yet among European patients admitted to the hospital in the 10-year period, to the number of 222 patients, no less than 22 per cent. were depressives.

Part of the discrepancy can be accounted for by the fact that, in a primitive country, many more manageable insane are looked after at home. This might account for an apparently low incidence of mildly retarded depressives, but would not apply to most agitated, stuporose or persecutory cases. In regard to the question of whether in fact many depressives occur and are not admitted to hospital, the suicide rate in the reserves is quite unknown so one can glean no information from that angle. There is, however, another possible approach to the problem, namely a study of murder from the psychiatric viewpoint and, since murderers are brought to justice in Kenya as in other parts of the world, comparisons can be made. Among a series of 300 Broadmoor homicides referred to by Norward East, the commonest type of mental derangement

found was melancholia, which accounted for over 20 per cent. of the cases. In a comparable series of 57 Kenya homicides who had been found guilty but insane, only 7 per cent. were depressives. Moreover, these figures take no account of the fact that in England roughly 38 per cent. of suspected murderers commit suicide before arrest and it may be assumed that many of these are depressives. In Kenya, where an enquiry was instituted in 5 districts on this point for the year 1946, among 56 Africans suspected of murder *none* committed suicide before arrest. If depression in Africans were clinically similar to this illness in England and many cases occurred in the reserves, one would expect a larger number of depressive homicides and of suicides of persons suspected of homicide. So, for what it is worth, these observations in regard to homicide support the contention that psychotic depression in the African reserves is either rare or atypical or both.

It, is however, believed that a number of cases occur which are not certainly diagnosable but are probably abortive depressives. From time to time patients are seen who are retarded and confused and *look* very miserable yet who cannot *say* whether they are happy or sad, though they commonly admit to vague feelings of bodily ill-health. In the final analysis it would seem that the only valid criterion of psychotic depression is "subjective depression out of proportion in severity or chronicity to exogenous causes." This illness, therefore, is hardly diagnosable unless the patient admits to feeling miserable. Yet it is definitely rare for an African patient at Mathari to make this admission,—few even of the diagnosed cases have done so. Moreover, with the African's superstitious attitude to life, one would expect him to admit more readily to misery than to happiness *if he felt it*. It is believed, however, that the African with his slight ability for introspection and for discrimination between body and mind, would tend to identify a feeling of depression with bodily ill-health, and it is finally deduced that many abortive cases of depression occur, but that classical depressive psychoses are rare.

(4) In the previous article it was argued that affective disorder as a whole was relatively rare since it accounted for only 3.8 per cent. of our admissions, whereas in American negroes it accounted for 8.3 per cent. It is now seen, however, that affective disorder accounts for at least 7.1 per cent. of our admissions, since many cases previously unclassified are now seen to be abortive cases of mania and depression. Moreover, the fact that more than three manics were seen for each depression, contrary to the relative proportions in Europeans, may be partly due to depressives being frequently regarded as *physically* ill and not sent to the *mental* hospital.

(5) The previous observation that many manics were responsible people is now explained in a different way, namely that *classical* cases of mania (with sustained elation and grandiose schemes) and of depression (in which classical cases hardly occur) are seldom seen except on a background of education or sophistication, which is after all a *sine qua non* for the obtaining of most responsible jobs in the European sense. Many abortive cases, not previously recognized as manic-depressive, occur in the more unsophisticated.

(E) It was recorded in the previous article that 12.3 per cent. of the cases admitted were suffering from unclassified psychoses. This high proportion

was explained largely on the grounds that medical histories were usually unobtainable and interpretation of tribal languages was inadequate.

These explanations remain true to-day, but an even more important factor has now become apparent. It was noted under the discussion of affective disorder that many abortive and hardly diagnosable cases occur. It was also noted in regard to schizophrenia that relatively few patients could be classed as paranoid and in fact few were typically catatonic, so that most African schizophrenics must be assigned to the rather ill-defined group called hebephrenics.

In general, therefore, well developed and classical examples of the non-organic psychoses are relatively uncommon in the African; and even when one has classified abortive forms of these disorders as exhaustively as possible there still remains a number of frankly undiagnosable cases. Such cases are commonly confused, excited, incoherent and emotionally labile and appear to coincide with the mental reaction types seen in European oligophrenics, of whom Tredgold says—"In many cases, indeed, it is impossible to place them in a definite textbook category; one can only say that the patient is mad." They might best be entitled "primitive psychoses."

It is not, of course, here suggested that the normal Africans we meet are intrinsically deficient. This would be as unfair as to place an Englishman with a bow and arrow in the Kalahari Desert and then certify him as feeble-minded because he required "care, supervision and control" in a Bushman environment. The African may well, for cultural reasons, exhibit a backwardness which is similar in effect. According to Tredgold, backwardness due to extrinsic causes and amounting to a retardation of 15 to 20 per cent. is found in about 3.5 per cent. of the school age population of England and Wales. Such "backward" persons are only separable from the intrinsically "dull" by a study of their background and response to education, and there is no evidence that mental derangement takes other than similar, and amorphous, forms in both. So that the common occurrence of such forms in Africans is not surprising.

It has already been deduced that normal African mentality closely resembles that of European psychopaths as defined in this article, and Tredgold maintains that such persons (in so far as they fall within the class of moral defectives) are "*mentally* defective . . . in fact, feeble-minded according to the definition," since they lack "common sense or wisdom." If Tredgold is correct and, since many certifiable mental defectives are also morally defective, it is clear that the distinction between the two conditions is often a very arbitrary one. As to whether the African can best be defined therefore as "backward" or "psychopathic" is a question which seems of little profit to pursue.

* * * *

One can now summarize the findings in regard to African mental derangement over the whole 10-year period, and such of the above-described peculiarities as are possibly relevant to the present theme are listed below.

(1) There is probably a very low general incidence of insanity among Africans living in their natural environment.

(2) Among general paretics there is a relatively large proportion of "expansive" cases.

(3) Arteriosclerosis and hyperpiesia are rare and their rarity is consistent with the theory that a mental attitude is often of primary importance in their causation.

(4) Normal African mentality closely resembles the mentality of a section of the European population which is commonly entitled "psychopathic" or "sociopathic."

(5) Paranoid types of schizophrenia, including paraphrenia and paranoia, are relatively much commoner in Africans who have been educated on European lines, or sophisticated by living in townships.

(6) Classical cases of mania, with sustained elation and grandiose schemes, most commonly occur on a basis of European education or sophistication.

(7) No sharp distinction could be made between involuntional melancholia and other types of depression, and classical examples of any type of depression are rare. Cases exhibiting hypochondriacal ideas and an appearance of misery but who deny subjective mental depression and ideas of guilt are not very uncommon, however, and are probably abortive depressions.

(8) Obsessional neuroses were never seen, and this was considered to be related to the absence of personally developed codes of behaviour.

(9) The condition entitled "Frenzied Anxiety," and fully described in the previous article, is now considered to be a psychopathic episode (with hysterical elements), and its frequency in otherwise apparently normal Africans is related to the findings described under the fourth heading of this summary.

(10) Many examples of abortive or "primitive" psychoses are seen, which closely resemble the reaction types seen in European oligophrenics.

These are the ten main points, and an attempt will be made to elucidate them further in part 6 of this article in the light of the studies undertaken in parts 3, 4 and 5.

3. A STUDY OF AFRICAN RELIABILITY.

The writer, as was stated in the introduction, was invited by the Kenya Director of Laboratory Services to prepare tests for the selection of *reliable* Africans for work in the Medical Research Laboratory, Nairobi.

It is a matter of common knowledge to employers of Africans in Kenya that the latter frequently "let one down" in a variety of ways. Moreover, this tendency is not confined to the most unsophisticated, but commonly occurs in the well-educated and apparently most intelligent, to the frequent astonishment and chagrin of their employers. Since the relations of Europeans and Africans are constantly embittered by this tendency in a land where the two must work together it is surely important to try to understand it.

With a view to devising suitable tests (with which the rest of this article is not concerned), it was decided to begin by discovering exactly in what ways the African "lets one down" (or lets himself down) and proves unreliable. With this in mind, three employers of Africans were invited to supply examples.

and I have added some from my own experience. The types of African concerned were domestic servants, mental hospital attendants, laboratory employees and various other persons, and all degrees of sophistication and education were fairly represented. To avoid bias and selection, *all* the examples are quoted (though some are trivial) except in so far as they repeat each other, and it should be noted that the Africans concerned were not feeble-minded or evil, but fair samples of their race.

The examples are quoted below in inverted commas, and my comments follow each quotation.

(1) "My cook often does not tell me he wants more firewood until the latter is quite finished, although I have often told him to warn me *before* it runs out so that I can arrange to get some more."

From the cook's point of view the firewood in the European's house is something to burn and nothing more. He is in any case not used to looking very far ahead, but if he does it is merely to think that the European is all-powerful and can doubtless produce firewood somehow when he needs it, and it is even possible that the sky might rain firewood at any moment.

(2) "I put shoes to be mended in my shopping basket the night before so that I shall remember to take them to the cobbler the next day; the house-boy takes them out, cleans them and puts them elsewhere, though he might assume they had been put in the basket for a purpose."

From the house-boy's point of view a shoe is something to be cleaned and put in a particular place, a completely incomprehensible ritual anyway, and so to be memorized by rote and performed unquestioningly.

(3) "I tell the house-boy not to put my shoes in the shoe-cupboard but I will do so myself, as he is apt to put black shoes on top of white, heavy shoes squashing others underneath, etc. For a few days he will do as I say, after which he reverts to his old habit, and this applies to much that I tell him to do."

This appears to be an example of a tendency common to all of us where meaningless rituals are concerned, namely to revert to a well-established habit before the new habit is stabilized.

(4) "The house-boys cannot put furniture back level with the wall, put the table at right angles to the wall, hang pictures straight, etc."

This requires a type of spatial perception that is foreign to the African; it can be learned in regard to specific positions for particular items, but a general geometrical orderliness is hardly attainable. His attempts to solve, for instance, the Cube Imitation performance test, which requires some spatial apperception, would be pitiful in a European child of eight.

(5) "The cook took a basket of vegetables out of the car and left the back door of the car open, though he should have known I was just going to drive into the garage, and did so in fact and broke the car door."

From the cook's point of view the car door was merely something to open to collect the vegetables; the other aspects of the door's situation in space and time would hardly occur to him.

(6) "The egg-boy brings eggs on Mondays and Thursdays. He failed to come last Thursday on account of the rain, so he did not come again till Monday, though there was nothing to prevent his coming on Friday."

An example of an unreasoning following of a routine.

(7) "A female mental patient escaped, so the head female African attendant sent all the other ten female attendants to look for her, and herself remained alone to look after about a hundred patients. If any others had taken the opportunity to escape, she would have been helpless."

An example of a complete failure to take account of the total situation in a balanced fashion.

(8) "A number of male mental patients and their African attendants were playing football, one patient ran away, *all* the attendants and some of the patients chased him and left the rest of the patients unattended."

My remarks are as for the previous example.

(9) "The African staff of the mental hospital had been warned that a certain patient was likely to attempt suicide by hanging and to see that no strings, straps, etc., were left about. Shortly afterwards the patient tried to cut his throat with a razor-blade and the attendant in charge said he had only been warned that the patient might *hang* himself and that if therefore the patient had asked for a razor-blade he would naturally have given him one."

An example of a failure to envisage the total situation, and of a common tendency to take commands quite literally and unreasoningly.

(10) "There are always two attendants together in any particular block of the mental hospital on night duty, so that if one has to go away to relieve himself there remains one on duty. If the remaining attendant happens to feel the same urge he will probably not await the other's return."

An example of a failure by attendants to realize their responsibility for their patients, and of the constant African failure to subordinate immediate personal needs to more long-term situations.

(11) "A good mental attendant of 15 years' service took his normal home leave and, soon after returning to duty, said a distant relation was ill and he must therefore go home again. This was not allowed and he was told that if he insisted he would be discharged and would sacrifice his high pay and a gratuity for which he was due. He insisted on leaving, but said he would return and begin again at the bottom, and in fact he did so."

This is an example of the precedence accorded to primitive custom even when it may ruin the subject's prospects within the European system, and the latter is treated as quite unimportant and irrelevant when it conflicts with the African.

(12) "Senior laboratory assistants to whom the proper care of a work-room has often been explained—e.g. efficient dusting, putting away of used articles, necessity for all specimens to be examined without delay, clear labelling of all bottles, etc.—are often quite incapable of seeing that either (*a*) they themselves or (*b*) their subordinates maintain these principles."

The African sees his (European) job as a series of isolated responses, not as a co-ordinate and meaningful whole. The attitude, implicit in any responsible job, that one takes certain matters entirely on one's own shoulders, controls one's subordinates, and troubles one's superior officer as little as possible, is foreign to him.

(13) "I constantly find laboratory assistants standing about doing nothing while there are plenty of slides lying ready for examination."

This is largely answered under the 12th example, with the additional comment that a sense of temporal urgency, so universal among Europeans and so necessary in a laboratory, is rarely felt by Africans except in the most directly personal matters.

(14) "Specimens are received at the laboratory, entered in a book, given a number, and labelled ready for examination. The specimen from Mr. X may be given the number of Mr. Y, and that from Mr. Y be given Mr. X's number."

This sort of slip is bound to happen at times if one tries to do two things at once and is due to a lack of system. Europeans, of course, make slips of this type, but, having discovered their error once or twice, they would be likely to develop a better system of their own; it is the continuance of this type of mistake that is striking in the African. Moreover, an inability to cope with more than one thing at a time is almost the crux of the problem as will be seen in other examples.

(15) "Hours of reasonable explanation and demonstration failed to teach an apparently intelligent laboratory assistant the proper use of an autoclave."

It is probable that he did not possess the educational background that would permit of complete understanding of the processes involved, and in any case was probably unused to the reasoning method and could not use it at short notice. Although the rote method of learning is inferior to the reasoning method in general, it is probably more effective with most Africans at the present stage of their development.

(16) "A laboratory assistant has been trained in the use and care of a microscope and *can* in fact handle it deftly, yet the 12th objective gets broken in an amazingly short time." This can be due to inserting a thicker slide without racking up with objective, or to racking down after inserting a thicker slide, and in general to ignoring the safety of the objective while attending to the slides: an example of a failure to attend to more than one matter at a time.

(17) "On being told to fetch, say, 3 blood agar slopes and 1 sterile test-tube, a laboratory assistant may return with, say, 1 blood agar slope and 1 sterile test-tube, or 4 tubes of each, etc., although it is as easy to bring the right items as the wrong, for they are all kept together."

This is unlikely to be due to a failure of retention—there is no evidence that the African's retentive faculty is so feeble. It is doubtless due to a failure of attention and registration, for the African often fails to register a matter if only told it once and without emphasis or emotion; indeed African conversation is highly repetitive and commonly punctuated by a word corresponding to the English word "Listen."

(18) "One calls the African telephone operator to get one Mr. X, he replies he will do so; after an interval of 5 minutes he asks if you wanted Mr. Y."

This appears to be mainly a lack of attention as described in the previous example. It is also probable that a familiar name was substituted for an unfamiliar, an attempt to fit a new experience into a familiar pattern and not keep an open mind. (A further example was given which showed the latter

tendency more clearly, but is not recorded here since it merely repeats the same theme.)

(19) "A laboratory boy is told to empty a certain basket (of used material) every morning. One day the basket is found unemptied and, on enquiry, he states that he thought they were unused materials. This is common in various forms; one often gives an order which sooner or later is not carried out because the boy thinks one has made a mistake. He is, of course, seldom in a position to appreciate the situation and never asks before acting on his own judgment. It is not due to laziness, but he probably sees an unfamiliar element in the situation (e.g. a different item in the basket) and feels that the rule cannot therefore apply."

In the absence of a proper understanding of the situation there must come a point where further alteration of the elements of the stimulus does not call forth the required response and the order is not felt to apply.

(20) "An African employee will suddenly ask for leave (to visit his sick grandmother, etc.) although this disrupts the staff organization, and he will be surprised and pained when permission is not readily granted."

My comments are as for the eleventh example. The African does not see his work for the European as an essential part of an organization, and it must be admitted that from his point of view his (European) work is *not* such an essential part of *his* situation as we would like it to be, for he is in effect often living two separate lives which he makes little attempt to reconcile, and his European work is often merely a means to earn money so that he can maintain his traditional mode of living in the reserve.

(21) "After doing a certain type of work at a certain required standard for some time, an African employee will one day do something quite inferior, e.g. omit to put forks on the table, salt in the soup, etc., and if he is not continually supervised or reprimanded his standard will probably progressively deteriorate."

Since his work consists of a series of separately memorized and meaningless acts, it is all too easy to forget certain essential items sooner or later and, in the absence of supervision, he will forget more and more of them. Furthermore he considers that most of the items are fatuous and unnecessary and that he might try omitting each in turn to see if his employer really notices and insists upon them. One cannot also ignore the possibility, on occasions when he lets one down in this way, that he has had bad news from home or suffered some other emotional upset, for such upsets disturb his efficiency more thoroughly than they disturb persons whose conscientiousness in their work is more deeply engrained. Finally, all his faults are more marked if he is not supervised; in the presence of his employer they are minimal, and he makes his master's attitude a part of himself in inverse proportion to his distance from him, like a child with its parents.

(22) "If an African employee sees some immediate advantage to himself and thinks he can get away with it, he is apt to behave in an utterly unscrupulous fashion from our point of view, e.g. a highly qualified African surgeon (not in Kenya) in doing hernia operations held the patient's relations to ransom before putting the intestines back. If discovered there is little or no shame."

The African as was seen in part 1 has no general conception of right and

wrong. Within his own culture he has precise and detailed rules, but these have no application to his life within the European cultural framework.

(23) "If an African in the reserves is walking on the road and one sounds the car-horn he will leap aside after an appreciable interval and then probably wander back onto the road without looking to see if another car is following behind."

The road, when he is walking on it, is a footpath and nothing more. He sees the passing car as an isolated and surprising incident, fails to bear continually in mind that a road is also a place for cars to drive along, and continually shows in certain circumstances, such as the situation here described, a relative lack of distractibility.

(24) "When things go wrong the African notoriously fails to blame himself—the environment conspired against him, it was a matter of fate, the cup slipped out of his hand, the drink made him slaughter his best friend, etc."

He does not see himself as a responsible causal agent, but as a pawn of fate, as was seen in Part I.

(25) "The African employee is apt to spend his monthly pay in a few days, and then starve or get into debt."

Money is something to be spent and, if one does not spend it, it will probably be lost or stolen. Any other course requires foresight and scheming which is foreign to him.

(26) "If kindness is shown to the African employee, or some relaxation of the usual discipline, he is apt to take advantage of this to see how far he can go."

He has no well-developed code of his own outside his reserve and Europeans vary from person to person, so he must find the length of the chain with each one, as a child does with each parent. Moreover, he believes the European is all-powerful and can grant all his wishes if he has the will.

(27) "After listening to a general scientific lecture, the African student is apt to ask some trivial personal question."

His interest, as has been shown, is mainly egocentric and unacademic.

(28) "Even quite a good boy will come on duty drunk at times."

He lives more vividly in the passing moment and takes little thought for the morrow. If there is drink going, it is there to be drunk, and fills the interest for the time to the exclusion of other interests, duties, etc.

(29) "A head-boy will quarrel with one of his underlings and expect his master to settle the matter; he does not feel it is up to him to settle staff problems himself."

My comments are as for those under the twelfth example. In fact a large proportion of African overseers, sergeant-majors, etc., are accordingly recruited from more or less detribalized peoples (Nubians, Swahilis, etc.,) who have acquired a more responsible attitude.

(30) "The house-boy will dust certain items in the room (as told), but will not keep the room in general clean."

He learns certain explicit rules of behaviour, but fails to develop a general abstract idea, such as cleanliness, tidiness, etc.

(31) "One calls the house-boy to bring dinner but he does not hear,

although it is well known to be dinner time and he is well within hearing distance, because he is talking excitedly to the cook about some small matter of personal interest to him."

He genuinely does not hear the call, an immediate emotional personal interest blots out all awareness of other stimuli. This, like the 23rd example, illustrates the African's lack of distractibility in certain circumstances. The domestic staff's ability to converse interminably and with eloquence and enthusiasm about the most trifling matters and to the exclusion of all other awareness, is also a notorious source of irritation to housewives.

(32) "If one asks any African a question, he is very apt to give the answer that he thinks you want."

From his point of view there is no *one* truth, it varies from moment to moment according to one's mood and that of one's audience.

(33) "An African employee commits a fault and one says one will deduct a shilling from his pay at the end of the month; comes the end of the month and the fine, and he deeply resents this because the offence happened in the past."

One cannot fine him at once because, except on pay day, he seldom has any money. He feels little responsibility for something he did in the past, and one even wonders at times if he regards himself as having a continuing personality.

* * * *

These are the examples. Individually they are not perhaps very dramatic and occur from time to time, of course, in experience of European employees. The striking thing, however, is that they would only occur frequently in Western European civilization in persons who would be considered thoroughly irresponsible, whereas Africans who do not frequently default in ways like these are rather exceptional people.

It now behoves one to see what common threads run through this patch-work of failures.

The first and most striking point is a failure to see an event as an element in a total situation, and as having a variety of relevant relationships. Only 3 or 4 of the examples do not show evidence of this failure. The relationships that were most frequently ignored in this series were *the causal, functional and temporal*, which are hardly separable, and of which at least 25 of the 33 examples show evidence. Examples of other ignored relationships, e.g. *spatial, ethical and occupational*, occurred, but less commonly. The inability to attend to two things at once, or at least to keep the second near to the threshold of consciousness while attending to the first, and which frequently accounts for a lack of distractibility, is clearly seen in 4 examples and is part and parcel of the same phenomenon.

The second point is a continual tendency to follow routine procedures in an unreasoning fashion, and of which there were at least 9 examples in this series. This point is closely linked with the first, and their relation to each other will be discussed later.

The third point is a lack of interest and attention unless the situation appeals

in a directly personal and emotional fashion. Of this again there were at least 9 examples.

A number of minor points arise but, since they were each seen in only one or two examples, it is not proposed to discuss them further. It is worth while noting, however, that there is evidence in at least two examples, 24 and 33) that the African seems to feel little sense of a continuing personality !

* * * *

In regard to the first point one must begin with a qualification, since it is likely that the African's failure to appreciate total situations does not apply in the world of sound.

Thus Biesheuvel says—"The Bantu have a flair for words and a remarkable ability to master languages. Many an African knows a few Bantu languages in addition to his own, while possessing a working knowledge of English and Afrikaans. He does not seem to experience the same difficulty in mastering the quite different structure of the Indo-European languages, as the European has in learning a Bantu tongue. Latin and English are among his best subjects in the High School curriculum. . . . As a group, Africans also excel in musical ability."

M. L. Fick, quoted by Biesheuvel, says—"The speed with which native students learn songs is remarkable. We use the Tonic Sol-fa system in our singing lessons. It takes them about ten minutes to learn an unknown piece of four lines in four parts. It is their custom after study and before they go to bed to sing some familiar hymn. Night after night we hear them singing, but only in two voices, namely bass and tenor. They say that the girls are singing the other two parts and so they need only sing *their* two. It is most remarkable that they succeed in singing in this manner, because the first voice, which introduces the tune, is not heard at all. This makes it difficult for us to make out what hymn they are singing. That it is possible for the native to do this shows that he is capable of representing imaginally the voices which are not sung. If the first two voices were not imaginally present they would not be able to keep their parts. Nearly every native is an amateur composer. Numerous new songs are sung annually here by students in small choirs. It happens sometimes, when they are busy working outside, that one of them hits on a tune—usually one he has made up himself—and after he has repeated it a few times, one after the other of the other students present joins in and, after a while, the simple tune has become a part song with a perfect harmony, sometimes in as many as five parts."

Finally Biesheuvel, referring to this quotation from Fick, makes from our present point of view the profoundly interesting observation that "This shows that at least in the auditory sphere, the African's ability to grasp, work out, remember, and create intricate new relations of a most abstract kind is by no means inferior to that displayed by the European in the visual or conceptual sphere."

The writer has previously referred to the African's dependence on the world of sound and of spoken words, and to his eloquence, and will return to

Biesheuvel's very interesting qualification of the general rule in the conclusion of this article, since it may well have a fundamental bearing on African thinking.

* * * *

To return therefore to our first point in general, it is, of course, pertinent to remark that no one, however brilliant and cultured, can hope always to see the total situation in all its relevant relations, but the attempt is commonly made and, for all practical purposes, is commonly successful. Moreover, the relevant relations of many situations *are* inevitably different for the European and the primitive African, e.g. when the latter departs to see his sick father, his (European) work is a relatively unimportant part of *his* total situation. The question therefore arises whether the African's failure to appreciate the total relevant situation from *our* point of view is (a) a mental disability in him, or (b) merely *apparent* to us and due to the fact that matters which are important from our point of view are *really* unimportant from his.

No doubt the second possibility is often true, but it is by no means the whole truth. Among the 33 examples there were only two (11 and 20) in which the requirements of the two cultures definitely conflicted. In all the other examples the failures were not directly due to environmental factors although, of course, such factors may explain the mentality that underlay them. Even if the European work is undertaken solely with a view to supporting life in the reserve, which is by no means always true, it should still be an important part of his total situation, and demands a sustained attention which it would receive from more sophisticated people in a like case. Many Europeans, after all, are employed on strange and uncongenial work, yet are efficient. Moreover, the European must and does often adapt himself to very new conditions of life, as when the boy is first sent to boarding school, the youth from the country drifts into the town, or the grown man emigrates.

To return therefore to the first possibility, it remains to discuss whether the disability is innate or acquired. The question is not certainly answerable but if one can show that, for environmental reasons, one could only expect the development of this disability, there is no need to assume it as innate.

Now, as has been shown before, in all African education in the reserves the "emphasis always lies on a particular act in a concrete situation;" he is taught to observe meticulous rules and restraints in a large number of particular and limited situations. Since his social and geographical environment changes little throughout his life, these rules are generally adequate to his needs. He learns no general principles that require directed thinking in their application, and indeed there is little scope and less encouragement for anything in the nature of original thought.

It is implicit in this that his attitude must be: "I may do anything that is not specifically and explicitly prohibited," whereas the European's attitude (ideally) is "I must refer my problems to the arbitration of my mind as a whole, working on the basis of a few general principles, and taking into account all possibly relevant aspects of the situation." The African attitude implies that, apart from certain swift and almost automatic responses and inhibitions,

he can do what he likes from moment to moment and feels little need to think of the future or indeed of any other than the immediately presenting aspect of the situation. So he feels free to exercise his most egotistic and emotional impulses (within well-defined limits) and such mental organization as he evinces is imposed from without and not self-developed. He is hardly in fact an individual in our sense of the word, but a series of reactions.

Cultural factors thus fully explain the ways in which the African lets one down, and lets himself down in our eyes. They explain his failure to take cognizance of the total situation, his lack of interest and attention except in directly personal and emotional situations, his continual tendency to revert to more simplified routines, and the disastrous failure of his infrequent attempts to think for himself.

More generally, and virtually implicit in this, such factors explain what are in our eyes his unreliability, his irresponsibility, his unconscientiousness, his lack of method and concentration, his impersistent moods, and his relative inability to keep more than one item in mind at once. His lack of self-consciousness seems also to be explained, since this faculty appears to be a by-product of mental synthesis.

The question as to whether the African's failure on these lines is due to a lack of ability or a lack of incentive and urge to use his potential powers is largely answered by this analysis, for it can be fully explained as due to the latter. Indeed it is notorious that many Africans who are brilliant by any short-term tests will commonly default in real life situations in such ways as described, and the failure appears to be one of total personality development rather than one of pure intelligence as measured by tests. One cannot, however, ignore the possibility that anatomical differences also exist, but this point will be discussed in the conclusion of this article.

4. THE EFFECTS OF LEUCOTOMY ON EUROPEAN PERSONALITY.

Relatively few leucotomies have so far been performed in Kenya, but many writers in Europe and America have noted personality changes after leucotomy as compared with the prepsychotic personality of the patients concerned, and the following is a summary of the findings of each writer whose observations are available to me.

Jan Frank, in a study of 200 cases, found no impairment of cognition or intellect in patients under 55 years of age, but there was a poverty or absence of dreams and daydreams, an inability to be abstractly angry in a sustained fashion, a tendency to become more plain and matter-of-fact due to emotional asymbolia, a dislike of adventure with a desire to remain in a more or less stereotyped routine of activities, and a reduction of learning ability.

C. S. Parker, in a study of 100 cases, found a tendency to placidity and laziness and for the patients to consider less the effect of their remarks and to say what they think.

E. L. Hutton, in a study of 10 cases, noted a diminution of self-consciousness with less shyness and reserve, a greater indifference to adverse criticism, less preoccupation with bodily functions, decreased awareness of other people's

feelings, emotional shallowness and no tendency to make new friends. In general there was an increase of self-indulgence and egoism, but with a wider range of interest in the environment. Some of the patients were less truthful, reliable, scrupulous and religious. Intelligence seemed unimpaired, but the sense of personal responsibility was reduced, and worry about the future was rare though the reaction to immediate situations was normal. She found the most outstanding feature in the *pre*-psychotic personality of these cases was an excessive social self-consciousness, and most of them were conscientious and meticulous. In another article she stresses the importance after leucotomy (if not before) of a regular disciplined routine—a matter of considerable relevance to our present theme. Hutton is elsewhere quoted by Henderson and Gillespie as saying that reproductive memory is replaced by associative memory so that the leucotomized patient lives in a perpetual present.

Sargent and Slater describe hastiness of temper, irritability, egotism, increased extraversion, an incapacity for sympathy to others, tactlessness, a lack of self-criticism, a loss of worry about the future and a tendency to live more for the present.

Hutton and Bassett record a loss of creative activity and deduce that this is due to a lack of ability or desire to re-organize images of perceived parts into new imaginary wholes.*

Meyer and McLardy, in a study of 95 leucotomized patients, found that the severer degrees of personality change were usually associated with a posterior position of the cuts, and that general restlessness was confined to such cuts.

Frankl and Mayer-Gross are quoted by Raven as finding the typical discharged leucotomy patient cheerful and contented, not worrying, having a high opinion of himself and his abilities, active and restless, with varied and variable interests especially for light entertainment and superficial pastimes, easy-going and sociable but without depth of feeling and with little sympathy or consideration for others, and without regrets. He may also be headstrong and tends to quickly passing outbursts of temper.

Freeman and Watts are quoted by Henderson and Gillespie and elsewhere by Garmany, as observing euphoria, tactlessness, lack of initiative, laziness, a tendency to be content with inferior performance socially and intellectually, a diminution in foresight and care for the future, talkativeness, poor judgment, and fundamentally a diminution of self-consciousness.

Golla is quoted by Garmany as finding an increased objectivity and response to environmental variations associated with little interest in remote possibilities, some rudeness and loss of sensitivity to other's feelings, and especially a loss of anxious self-questioning as to the ethical rightness of projected activity; and as finding the patients guided by a conventional moral code which is not coloured by the usual emotional concomitants.

* Ashby and Bassett have since concluded that "creative ability is not markedly impaired by prefrontal leucotomy," but this conclusion was based on comparison with psychotic patients who, as the writers show, have a significant lack of such ability as compared with normal persons. So that their study *does* probably demonstrate a loss of creative ability as compared with the *pre*-psychotic personality, which is here our sole concern.

Freudenberg and Robertson's study appears to demonstrate that there is no loss of rote memory (as shown in the immediate and delayed recall of a number of seen objects), but that there is a reduction of meaningful memory and capacity to learn from experience as shown in the Paired Associates, Kohs Blocks, and Sorting Tests). They also noted a diminished punctiliousness and a diminished capacity to deal with spatial relations, and considered finally that all these changes were due to a mixture of cognitive and conative factors, and could not be explained on the basis of either factor alone.

Spurling's case of bilateral frontal lobotomy, as quoted by Garmany, was subsequently explosively irritable, given to vulgarity, and showed difficulty in synthesizing or in remembering more than one detail at a time.

Russell Brain considers from the evidence of leucotomy that the frontal lobes are concerned with foresight, imagination, the apperception of the self, and the adjustment of the personality as a whole to future contingencies.

Earl Walker, as quoted by Fleming, finds an inability to synthesize the problems or situations of the external world.

Brickner, as quoted by Brain and Strauss, observed (in a stockbroker leucotomized at the age of 40 years) euphoria, lack of insight and initiative, distractibility, selfishness, tactlessness, sexual disinhibition, and a virtual absence of new learning, and considered that the fundamental defect lay in his powers of synthesis—in his power to assemble groups of percepts into groups of a higher order.

Cobb, as quoted by Meyer and elsewhere by Garmany, is opposed to regarding the frontal lobes as centres for specific traits (e.g. foresight or imagination) and believes they merely permit of long-circuiting actions, and that the effect of leucotomy is simply to reduce the number of possible circuits of association.

Petrie's comparisons were made with the pre-leucotomy, not the pre-psychotic, personality and so are not strictly relevant to the present study. Nevertheless they are too important to ignore and, in so far as they are likely to be relevant, are here recorded. She found a loss of persistence and of cautiousness, of capacity to generalize and to plan (as seen in mazes), a diminution of self-blame and a tendency to leave the past behind, live largely in the present and look hopefully to the future, a loss of comprehension and of social sense, a lessened distractibility, a lost appreciation of the finer distinctions of language with a decrease of critical attitude in its use, and a loss of learning ability (as shown by an increase of double mistakes in mazes) with an increased facility in the performance of routine tasks which had once been learned.

Finally, it is only fair to record that various authors, for example Garmany, maintain that there need be no permanent personality change ascribable to the operation alone, especially if the assessment is made after a considerable time. Nevertheless, it is clear that personality changes on the lines described, are frequent; and it is most probable that their degree is roughly proportional (other things being equal) to the completeness with which the frontal cortex is separated from the rest of the brain, as evidenced especially by Meyer and McLardy's studies.

A summary of these findings would run as follows :

The prevailing mood is one of cheerful self-satisfaction, and emotions are more directly egotistical and transitory and little felt in more altruistic and abstract situations. Interest in the environment is more varied and variable, wider but more superficial, and concerned with its more immediately utilitarian aspects. There is a lack of self-criticism and self-consciousness (social and probably personal), and a lack of sympathy for the feelings of others. There is an inability to envisage, or a lack of interest in, the future implications of a course of action, a lack of regret for past actions, and a tendency to live more in the present. There is a lack of sense of right and wrong in any general sense, though a conventional religiousness is common. There is a lost appreciation of the finer distinctions of language and a decreased critical attitude in its use. There is a difficulty in synthesizing or in remembering more than one detail at a time, a lessened distractibility, a loss of creative activity due to a lost ability or urge to reintegrate images, and a preference for stereotyped routines. The reduction of learning ability may or may not be dependent on conative factors included above, and the hyperactivity seen in some patients appears to be a quite inessential result of the operation and dependent on abnormal incisions. All the other qualities mentioned are directly consequent upon or implicit in those mentioned.

On analysis it appears that, when the leucotomized patient shows a personality change at all, it is in the direction of a *failure to see an event as an element in a total situation and as having a variety of relevant relationships*. The relations referred to by the above-quoted writers were causal, functional, spatial, temporal, verbal, social, ethical and aesthetic. Interest in the environment is accordingly more superficial and concerned with its more immediate and directly utilitarian aspects, emotions are transitory and the emotions described by Thouless as sympathetic and disinterested are hardly felt. A preference for stereotyped routines is also common and probably related to the inability to integrate for oneself, and the reduction of self-consciousness is probably a direct result of reduced integration. Finally, a reduction of learning ability has been described and this is probably partly a natural consequence of the self-satisfaction and lack of incentive, but may also be an independent disability.

5. AN ASSESSMENT OF THE RESEMBLANCE BETWEEN THE AFRICAN AND THE LEUCOTOMIZED EUROPEAN, AND SOME DEDUCTIONS.

Except in so far as the African's ritual training mitigates some of the more socially flagrant symptoms (e.g. rudeness and tactlessness), and except that the African shows no lack of verbal ability or of phantasy, the resemblance of the leucotomized European patient to the primitive African is, in many cases, *complete*.

It would have been possible to write the analysis of the leucotomized European's mentality in words that echoed the analysis of the African's ; but it would have made wearisome reading. The writer has, indeed, often been struck by the fact that words and phrases used with reference to leucoto-

mized patients were equally applicable to most East Africans. It seems also not without significance that at least one of the few Europeans leucotomized in Kenya has, since his operation, consorted much more happily with Africans than with Europeans, in marked distinction from his previous behaviour, and to the great embarrassment of his relations.

* * * *

From all this it is inferred that the main function of the frontal lobes is the integration of stimuli arriving from other parts of the brain (thalamus and cortex), and that the African uses his frontal lobes but little for this purpose. The specific rules and taboos that govern his life are learned unreasoningly and retained in mind as feats of memory. It is likely that rote memory is little if at all affected by leucotomy, so one must assume that this faculty is served by more posterior parts of the brain. Now since much of African learning appears to fall into the class of rote rather than meaningful learning, since "meaningful" signifies "related in a consequent fashion to previous experience," and since the chief demonstrable function of the frontal cortex is synthetic, it seems most likely that meaningful learning is a function of the frontal lobes and rote learning of other parts of the brain. If this is true, then it is seldom necessary for the African to use his frontal cortex except for verbal synthesis, and he seldom directly (as opposed to phantastically) does so.

* * * *

It is assumed in this article that leucotomy is similar in effect to lobectomy. This assumption is probably not quite legitimate though, in those cases where the operation of leucotomy has really been confined to a severance of the thalamo-frontal tract, it is likely to be true. In fact, however, as shown by autopsies, it has seldom been so confined and has at times almost amounted to lobectomy.

Moreover, the described effects of lobectomy are closely similar to those of leucotomy. Halstead, for instance, in a study of 26 frontal lobectomies, found an impairment of four factors: a central integrative factor, a factor of abstraction, a power factor (which "operates to counterbalance or regulate the affective forces") and a directional factor, factors which might well be used to describe the shortcomings of leucotomized patients.

Admittedly Halstead found that an index based on these factors did "not appear to be altered significantly by prefrontal lobotomy" (leucotomy), but he based this finding on comparison with the *pre-operative* personality and it is clear from his own figures that *these* subjects showed a substantial impairment of the index *before* operation.

* * * *

One is led at this point to see if these deductions have any bearing on African psychiatry and if the peculiarities observed in the latter can be explained on these lines, and part 6 therefore consists of an attempt to answer three questions.

6. AN ATTEMPT TO APPLY THE DEDUCTIONS MADE IN PART 5 TO THE PECULIARITIES DESCRIBED IN PART 2.

Each peculiarity listed in the summary at the end of Part 2 will be discussed in turn.

(a) "There is probably a very low incidence of insanity among Africans living in their natural environment."

This was previously explained as being due to an absence of problems in the social, sexual and economic spheres. There is therefore little need for original personal thinking, and if our theory is correct, little need to use the frontal lobes. So that certain types of mental derangement which, as it is hoped to show later, are dependent on the use of these lobes, are unlikely to occur. Their absence or rarity largely accounts for the low general incidence of insanity.

(b) "Among general paretics there is a relatively large proportion of expansive cases."

This was previously thought to be due to an unmanageability of this type of case at home, and this may partly account for the phenomenon, but another possibility now arises. In general paralysis the chief impact of the disease, as observed at autopsy, is upon the frontal lobes. It was recorded in the previous article that the cases "were all in an advanced stage of the disease at the time of their admission." If the African seldom uses his frontal lobes, one would expect the disease to advance to a very complete destruction of the frontal cortex without his showing much mental abnormality, always provided the rest of the brain were little affected. So that one is led to wonder if expansive symptoms are frequently simply a late expression of the disease and occur when the latter has seriously involved more posterior parts of the brain. It may be that such late cases, though previously common, are now seldom seen in England, or that in England the picture in late stages is now altered by early treatment.

(c) "Arteriosclerosis and hyperpiesia are rare and their rarity is consistent with the theory that a mental attitude is often of primary importance in their causation."

These conditions are all too frequent in Western Europe and their frequency, as was shown in the previous article, may well be due in many cases to mental attitudes that are seldom seen in Africans. Since, from a neuro-physiological angle, the chief difference between these peoples seems to be that the former more habitually use their frontal cortex, one wonders if these vascular abnormalities are in some way dependant on frontal lobe use or misuse. If so, one would expect leucotomized hyperpietics frequently to show a fall of blood pressure. This expectation is fulfilled in the finding of Donovan, Galbraith and Jackson who, in describing "some of the apparent alterations in vegetative functions after leucotomy," observe that "a fall in blood-pressure seems to be invariable. . . . Frequently the fall seems to be in direct proportion to the preoperative level, i.e. the most extensive lowering of systolic pressure generally occurs where the initial reading is comparatively high." From a

study of figures kindly supplied to me by one of these writers it appears that, in those (14) cases whose preoperative systolic blood pressure was 160 mm. or higher and who were re-examined not less than four months after the operation, the average decrease at the final reading was 22 mm. (or 11 per cent.). Moreover, Tibbetts has recently described a case in which the blood-pressure during the three weeks before leucotomy varied from 170/100 to 260/160, whereas for the 16 months during which the patient was examined afterwards the blood-pressure remained stabilized between 140/95 and 160/100.

(d) "Normal African mentality closely resembles the mentality of a section of the European population which is commonly entitled psychopathic or sociopathic."

It is clear from the study of this subject in Parts 2 and 3 that the only difference between the normal primitive African's behaviour and that of Europeans who are "psychopathic" (as defined in this article) can be explained as due to the mitigation of the more anti-social symptoms in the former by the fact that their lives are completely governed by meticulous rules of manners and behaviour. In circumstances where these rules no longer apply, or in the uncommon cases where the rules have not been learned, the African is apt to become frankly "psychopathic."

Now it has already been inferred that the African uses his frontal lobes very little, so the further inference is now made that psychopathy as defined is due to the non-use of these lobes. This deduction must imply firstly that the operation of leucotomy tends to convert patients into psychopaths, and secondly that it is useless to attempt to cure "psychopathic" cases by leucotomy. So one is led to ask if these implications are true.

As far as the first point is concerned there seems little doubt that this is just what leucotomy often does do. Leucotomy is an imprecise operation and, since it is well known that not all leucotomized patients show the full anti-social tendencies that many do, it may well be that the best results often occur where the operation is not complete. Having regard also to the previous remarks about primitive African education and its effect in governing his social behaviour, one has been profoundly interested by Hutton's discussion of the management of leucotomized patients. The following quotations are from this writer, but the italics are my own. Hutton says: "There is some evidence that after leucotomy the patients become more extraverted, are more susceptible to external influences, and more objective and materialistic in their outlook. If this be true, then any desired change in the patient's behaviour must to an increasing extent be conditioned from *without*, and opportunities must be provided for the re-establishment of previous good habits, and strenuous efforts made to replace bad habits by some satisfactory ones. . . . If many good habits had previously been formed, the sooner the patient can be returned to his normal surroundings the better. . . . As far as possible, old interests should be revived and new ones introduced, and a *regular disciplined routine adopted in order that stable habits of a satisfactory kind may be formed.*"

The second implication has to meet the objection that Mackay leucotomized 19 psychopaths and found that 7 were remarkably improved or recovered.

However, Frank found only one social recovery among eleven leucotomized psychopaths, Henderson found no social recovery in four cases, and Engler among 38 mental defectives selected for severe conduct disorder found only three who showed considerable improvement. So that if one summarizes these findings one only finds about 15 per cent. of social recoveries. It must be admitted, however, that symptoms of tension and aggression are frequently ameliorated by leucotomy, but these symptoms are by no means a universal concomitant of psychopathy as Curran and Mallinson have clearly shown. Indeed, it is probable that aggressive tendencies are not positively correlated with psychopathy as defined in this article, though they are doubtless more likely to achieve overt expression in such people. Probably the great majority of psychopathic persons fall under the heading described by Henderson and Gillespie as "Inadequate" as opposed to "Aggressive," and I have found no evidence that leucotomy can cure the former.

So these implications of the argument seem to be true and the argument itself is supported.

(e) "Paranoid types of schizophrenia, including paraphrenia and paranoia, are relatively much commoner in Africans who have been educated on European lines, or sophisticated by living in townships."

The criteria used in separating paranoid from other types of schizophrenia were a tendency to chronicity in the delusions and a fairly good preservation of the personality in the former.

Although systemization of the delusions was not demonstrated in all the paranoid cases, it certainly occurred in some degree in most and was obvious in many. Among the non-paranoid cases on the other hand, systematization was not seen. There is clearly a high positive correlation between delusional chronicity and personality preservation on the one hand, and delusional systematization on the other. This is, of course, well known and not surprising. Preservation of the personality after all simply means that the subject's reactions are related in an obviously continuous manner to his experience as a whole, and do not vary in an apparently haphazard manner from moment to moment, and delusions in these circumstances can hardly be other than chronic.

So that the preservation of the personality and chronic delusions must usually be based on some degree of systematization, and it is precisely this quality which the primitive African and the leucotomized European tend to lack.

If the previous inference that the ability or desire to see events in a wide setting is a European acquisition, it is therefore not surprising that paranoid types of schizophrenia would mainly occur in Africans educated or sophisticated on European lines.

Finally, if as seems true, systematization is essentially a function of the frontal lobes, one would expect leucotomy to be more effective in paranoid than in other types of schizophrenia, and this is borne out by the records. Thus Frank found a social recovery in 48 per cent. of 80 cases of paranoid schizophrenia, but only 12 per cent. of 52 other schizophrenics; Henderson found social recovery in 41 per cent. of 22 paranoid cases, but only 24 per cent.

of 50 other schizophrenics ; and Garmany found social recovery in 50 per cent. of 10 paranoid cases, but only 11 per cent. of 27 other schizophrenics.

(f) " Classical cases of mania, with sustained elation and grandiose schemes, most commonly occur on a basis of European education or sophistication."

In leucotomized patients emotions are transitory, and the ability to sustain emotions appears to depend on the integrity and active functioning of the frontal lobes.

Grandiose scheming is highly characteristic of many manic Europeans but scheming implies concern with the future which, on the evidence of leucotomy, is essentially a function of the frontal cortex.

So that, if the African seldom uses these lobes, one would expect mania in him to show the peculiarities described.

(g) " No sharp distinction could be made between involutional melancholia and other types of depression, and classical examples of any type of depression are rare. Cases exhibiting hypochondriacal ideas and an appearance of misery but who deny subjective mental depression and ideas of guilt are not very uncommon, however, and are probably abortive Depressions."

It is well known that the retardation exhibited by many depressives is more apparent than real and that in fact many "retarded" depressives do not experience a reduction of thought processes but, on the contrary, experience so many conflicting lines of thought which they vainly attempt to reconcile that they become unable to make decisions, or even at times to express themselves except after much delay. It seems likely that one of the factors in the production of the syndrome known as psychotic depression is an *excessive* tendency to view the situation as a whole, and one is sometimes led into arguments of phantastic intricacy when conversing with these patients. If this tendency is a function of the frontal cortex as is likely from the evidence of leucotomy, and if the African seldom uses this cortex as the evidence indicates, then one would not expect depression, at least in classical forms, to be common in the African.

The inability of the African depressive to recognize his depression as a mental rather than as a physical state seems to be simply a part of his general lack of introspective ability and developed self-consciousness, which again are probably by-products of the habit of synthesis.

The absence of ideas of guilt and unworthiness is again predictable since he seldom views himself as other than a pawn of fate, and can hardly do otherwise in the absence of a developed sense of continuous personality.

Finally, leucotomy has scored one of its greatest triumphs in the treatment of chronic depression. If one summarizes the results described by Frank, Garmany, Henderson and Parker, one finds that among 103 patients leucotomized for depression a social recovery was obtained in 67.9 per cent. So that this illness appears to be highly dependent on frontal lobe function and, in general, the peculiarities seen in African depressives are such as one would expect in persons whose frontal lobes are dormant.

(h) " Obsessional neuroses were never seen, and this was considered to be related to the absence of personally developed codes of behaviour."

It is clear that obsessional neuroses are highly dependent on frontal lobe

function since leucotomy has been more consistently successful in the treatment of this condition than in that of any other.

The theme was developed in the previous article that the growth of personal standards of conduct is highly characteristic of Western European as opposed to primitive societies, and that the latter are governed by a host of precise rules—externally imposed and learned by rote. These rules are presumably stored as memories in posterior parts of the brain since it seems that leucotomy hardly interferes with memory. The correlation of memories and experiences which is required for the development of personal codes appears to be a function of the frontal lobes. So that the previous argument that obsessional neuroses can only occur on a basis of personally developed codes of behaviour is now supported by the neurophysiological considerations developed in this article and by the facts of leucotomy.

(i) "The condition entitled 'Frenzied Anxiety,' and fully described in the previous article, is now considered to be a psychopathic episode (with hysterical elements), and its frequency in otherwise apparently normal Africans is related to the findings described under the fourth heading of this summary."

African mentality in general, as has been shown elsewhere in this article, closely resembles the mentality of a group of Europeans commonly called psychopathic.

For the most part Bantu Africans are very happy-go-lucky and inaggressive and would fall into the class of psychopaths called "Inadequate." The distinction between inadequate and aggressive psychopaths is, however, a very arbitrary one, and in effect merely depends on the fact that the former (unlike the latter) have not *so far* exhibited aggressive episodes. In the face of severe frustration, episodic reactions of the type described as psychopathic are clearly most likely to occur in "persons who live in a perpetual here-now and lack the desire or ability to control their passing emotions and so to subordinate immediate gratifications to their own long-term interests."

Severe degrees of frustration occur frequently enough in primitive life. Behind the carefree façade and constantly restricting behaviour there lies the ever-present fear of bewitchment. So long as all goes well it lies dormant, but when things go wrong this fear inevitably develops side by side with the more obvious misfortune, and the subject frequently reaches a pitch of helpless terror which cannot be mitigated by a larger understanding to the total situation. In these circumstances an explosive reaction must result and the frequent occurrence of frenzied anxiety is explained.

The commonly superadded hysterical elements seem to require no special explanation in this context since, as Lewis says, "The occurrence of hysterical mechanisms in children, and their frequency in healthy adults, especially after calamities or in unendurable conditions . . . suggest . . . that hysteria is potentially present in most people." In other forms it is certainly not uncommon in Africans.

(j) "Many examples of abortive or 'primitive' psychoses are seen, which closely resemble the reaction types seen in European aments."

In general there is a marked difficulty in making a differential diagnosis between various types of psychoses in primitive Africans and some of the

more characteristic symptoms, especially the delusional systems and sustained mood changes, are conspicuous for their absence or unobtrusiveness.

These symptoms in general appear to depend on the full functioning of the frontal lobes and, in the absence of this, insanity takes a somewhat amorphous form.

It has already been suggested that the African exhibits a backwardness which must be similar in effect to intrinsic dullness and likely to result in similar types of mental derangement.

If the function of the frontal lobes is essentially synthetic and if the African (for cultural reasons) makes little use of these lobes, he must show a lack of "wisdom and commonsense" and, if intelligence is the ability to educe and apply relations, a lack of intelligence.

So that African backwardness and the occurrence of "primitive" psychoses can well be linked with frontal idleness.

7. DISCUSSION AND CONCLUSION.

The main function of the frontal cortex seems to be the correlation and synthesis of stimuli from other parts of the brain—cortex and thalamus. It is at least one further remove from direct environmental experience than is any other part of the brain, and only has direct experience of other mental events. From a utilitarian point of view it delays reaction until comprehension of a relatively total situation (cognitive and orectic) has been encompassed. As by-products this entails a high degree of self-consciousness and a well-developed sense of personal continuity.

On the evidence of normal African behaviour, and supported by our psychiatric findings, it seems that these functions are markedly lacking in the primitive African and it is accordingly inferred that he uses his frontal lobes but little.

* * * *

There, is however, another possible inference, and which may explain certain facts more adequately. On Gestalt theory, seeing aspects of the environment as organized wholes is a function of most if not all of the cerebral cortex. Synthesis may well be a function of all areas of the cortex, and the effects of leucotomy may be largely quantitative and result from a reduction of total cortical volume.

On this theory, the slight effect of leucotomy in many Europeans and the apparently *complete* recovery of others might be most simply explained, and the peculiarities of primitive African mentality might also be seen as a failure of development or lack of function of the cortex *in general*, an approach which would accord with Vint's observation that "the cortex of the native brain was found to be narrower than that of the European."

It is to be noted, however, that this alternative theory is not flatly contradictory to the first, and its acceptance would not invalidate the general argument. Whether or not more posterior parts of the cortex also have *general* synthetic functions, it is very clear that the various posterior areas have

particular (synthetic or other) functions. Whereas the frontal cortex appears to have *no other* than general synthetic functions. So that a lack of general synthesis, such as is seen in primitive Africans, must leave the frontal lobes in *relative* idleness.

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However this may be, there is one striking exception to the general rule (of African synthetic lack), namely, that there is no lack of auditory synthesis, and it behoves one, therefore, to consider what might be the implications of this in mental development.

The primitive African, as has been seen in Part I, lives to a relatively large extent in a world of *sound*. This world, in a primitive environment consists of a limited number of items; the wind in the trees; the burble of running water and the hissing of rain; the crackling of fire; thunder; the noises of animals, and the voice and music of man. Now it is to be noted that all these sounds usually carry implications of direct importance to the hearer and are charged with emotional value. Indeed, they are all common subjects of poetic inspiration within our own culture. Even words *as spoken*, and in contra-distinction to the written word, are usually of direct importance to the hearer. Moreover, they are hardly separable from the speaker, and commonly convey emotional impressions and indications of attitudes in the latter which are in no way contained in the words themselves.

The Western European, on the other hand, lives largely in a world of *sight*. From an early age he is introduced to reading and writing, a wealth of toys (building blocks, jigsaws, etc.), ball games, and a variety of mechanical devices. Comprehension of all these items depends upon a high degree of visual awareness and leads inevitably to a well developed sense of spatial and temporal relations. This visual awareness, moreover, introduces man to a highly *irrelevant* world—a multitude of objects of which at any moment only a few are of the slightest direct interest to the observer. Even the printed word, as compared with the spoken, is impersonal and lacking in emotional value. Finally, the visual world has a quality of *continuity* quite lacking in the world of sound, and the combination of relative objectivity with a sense of inevitable continuity in space and time must deal a death blow to the world of “personal will” and pave the way for the development of a sense of the *inherent nature of cause and effect*.

At first sight it might not seem important whether mankind is introduced more insistently to the world of sight or the world of sound, but on further consideration it seems that its importance can hardly be overstressed. An understanding of the world we live in, and the development of an objective attitude and of mature responsibility depend on a well-developed sense of spatial, temporal and causal relationships and these in turn on a habit of visual, as opposed to auditory, synthesis. In whatever degree the world of “things in themselves” is real, there seems little doubt that the *visual* qualities of these “things” form the most valuable part of our “*behavioural* environment.” It is by no accident that the word “foresight” has a visual connotation, and by no accident that vision unlike hearing is dependent on *cortical*

integrity, and it is clear that verbal and musical ability alone must fail to develop most of those faculties that make man pre-eminent, must leave him grossly dependent on aspects of the world which are of directly personal interest and emotional appeal, and must leave the frontal lobes in relative idleness.

* * * *

It has been suggested throughout this article that African thinking is conditioned by his culture, and by the limitations of this culture. Such factors can indeed explain his limitations, but it is also possible to argue that societies have the culture they deserve. There is no reason to assume that the African has a constitutional deficiency since environmental factors can entirely account for it. Nevertheless there *may* be anatomical differences. In view of various other bodily differences it would be rather surprising if the African brain were identical with the European. The field is largely unexplored and calls for expert study. Vint's studies in this field were mainly concerned with the cortex, but it would also seem most profitable to examine the optic thalamus and the long frontal association tracts. Anatomical differences might not be wholly flattering to the European. In view of the African's highly developed powers of auditory synthesis, it is, for instance, possible that his uncinate fasciculi may be relatively large, though it is surmised that his occipito-frontal tracts are small. Admittedly such differences, if found, might throw no light on the nature-nurture issue since, as Tredgold says, "The medullation of the fibres concerned in association takes place still later; and there is evidence that this, and possibly also an increase in their number and complexity, may be continued for many years of life. Thus it was shown by Kaes that a progressive increase in the number of these fibres takes place up to middle age, after which growth ceases and eventually a gradual diminution occurs. *Doubtless the amount of increase is dependent to some extent upon the stimulus afforded by education,*"* and it is an important factor in intellectual capacity." Nevertheless such studies might throw light on the limitations of African adult mentality and, if made on infants, might supply more fundamental information.

Finally, on the basis of the African's resemblance to a certain type of European psychopath, one is led to wonder if there is in the latter also a failure of frontal function. Since in these cases environmental factors are usually less obvious and certainly *less uniform*, it seems even more likely that anatomical studies might here be fruitful than in the case of the African.

SUMMARY.

This article sets out to study normal mentality and mental derangement in the African, especially in regard to their peculiarities as compared with their counterparts in the Western European.

It is considered, on the evidence of leucotomy in Europeans, that all the observed African peculiarities can be explained as due to a relative idleness of his frontal lobes.

* The italics are my own.

This frontal idleness in turn can be accounted for on cultural grounds alone, but the possibility of anatomical differences, is not thereby excluded.

Finally, a plea is voiced for expert anatomical study of the African brain and, in view of his resemblance to a certain type of European psychopath, of the brains of the latter also.

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PSYCHOLOGICAL CHANGES FOLLOWING PREFRONTAL LEUCOTOMY; A REVIEW.

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	PAGE
I. CLINICAL STUDIES:	
(a) General clinical studies	50
(b) Specialized clinical studies	56
(c) Pathological studies	57
(d) Studies using modified operative techniques	59
(e) Summary	62
II. STUDIES USING PSYCHOLOGICAL TEST TECHNIQUES:	
(a) Cognitive tests	64
(b) Special investigations	67
(c) Summary	77
III. GENERAL CONCLUSION	79

THE literature on prefrontal leucotomy has been reviewed previously by Freeman and Watts (23), Fleming (15, 15*a*), Kisker (50), Walker (93), Partridge (69), Klebanoff (52) and Robinson (81). Of these, Klebanoff's review of psychological changes in organic brain lesions and ablations, including leucotomy, is probably of the most interest to psychologists because of his emphasis on statistical and methodological considerations. Fleming's (15*a*) review, being both up-to-date and comprehensive, is probably the review which is of most interest to clinicians.*

The present review is specifically concerned with investigations on psychological changes following prefrontal leucotomy. Thus, studies such as the Columbia Greystone Project (60) on cerebral topectomy are excluded from consideration. The field is more circumscribed than that covered by previous reviewers, and an attempt is made to describe individual investigations in greater detail. Large scale statistical summaries, such as that of the Board of Control (102) and of Ziegler (100, 101), are not discussed. The differences, from one hospital to another, in psychiatric diagnoses and in the criteria of postoperative adjustments are such as severely to limit the value of these summaries.

* I am indebted to Dr. Fleming for his kindness in allowing me to consult and to quote his paper in advance of publication.

I. CLINICAL STUDIES.

(a) *General Clinical Studies.*

In an early report Moniz (65) describes his procedure and the results from his first group of patients. This procedure as first developed consisted in the injection of alcohol into the sub-cortical white matter of the prefrontal area. Subsequently sections were made in the sub-cortical white matter by a leucotome with a steel loop which tended to crush the white matter in the area ; and, later still, a leucotome was used which had a steel band that cut rather than compressed. He concludes from the first 38 patients " from mental hospital and clinic " that deteriorated patients obtain slight or no benefit from the treatment, but that with patients ill for less than $5\frac{1}{2}$ years, including schizophrenics, " clinical recoveries have been observed." Some of the patients left hospital and assumed their usual occupations. In the light of future research perhaps the most important suggestion in the report is that leucotomy is contraindicated for deteriorated patients.

In America, Freeman and Watts have been the main exponents of prefrontal leucotomy. Freeman and Watts' operative technique, a " blind " approach utilizing skull bearings to locate the position of the incision, is described in their major monograph (23). Their results have been reported in a series of papers (94, 21, 22, 25, 26, 28). Exact percentages of recoveries considered good, fair or poor in the various diagnostic groupings fluctuate as the number of cases has been increased. This is unavoidable, and is probably due to developments in operative technique, to variations in the psychiatric material and to unreliabilities of post-operative assessment. It does mean, however, that to quote any given set of figures may be misleading. The general trends indicate that chronic anxiety states, involutional depressions and obsessional disorders respond best to leucotomy, having a " good " recovery in half to two-thirds of the cases ; schizophrenia is most difficult to relieve, having a " good " recovery in under half the cases operated upon.

In the selection of patients three broad criteria are suggested (94, 23, 24, 25, 26). These are (1) poor prognosis, (2) failure of other treatments, (3) selection should be based upon symptomatology rather than upon type of disease. Emotional response is said to be the most important criterion. When emotion dies out the patient is not suitable. Hence docility, vagueness, true apathy are contraindications ; apprehension, tension, anxiety, depression, agitation, hypochondriacal ideas—these may be relieved by the operation. The importance of adequate convalescent care is stressed (24, 25), especially after an extensive operation.

Mixter, Tillotson and Wies (64) reported two cases of agitated depression who, after leucotomy, showed a relief of symptoms. An affective desensitization of the psychosis seemed to take place, lessening the hypermotility and abnormal concern. Strecker, Palmer and Grant (87) reported favourable results from a group of 16 agitated depressions, of whom 12 (75 per cent.) recovered sufficiently to live in their own homes " in a relatively satisfactory degree of emotional adjustment." Five chronic, violent schizophrenics " improved " after leucotomy : in three cases the " gain was considerable," two of these patients being

discharged. The authors feel this to be a definite "salvaging of psychotic material which would have been adjudged irretrievably lost."

McGregor and Crumbie (54, 55) reported results on small groups of psychotic patients, predominantly cases of schizophrenia and melancholia. Of these, over half the melancholics made social recoveries as compared with about 20 per cent. of the schizophrenics. The authors felt that the best results were among those cases who show by their response to other treatments that they are potentially capable of recovering, though not of maintaining normality by these means. Petersen and Buchstein (70) reported the results of leucotomizing 46 chronic psychotic patients selected on the criterion of presence of "psychic tension," the majority of whom were schizophrenic, mainly of the hebephrenic sub-group. Though their results were "not spectacular," they concluded that prefrontal leucotomy is a valuable method of treatment in certain chronic psychoses.

Rees (76) discussed the indications for prefrontal leucotomy, basing his remarks presumably upon a group of 30 patients, the diagnosis and chronicity of whom are not discussed. In this group 9 patients (30 per cent.) made social recoveries, and 13 (43 per cent.) are improved for the hospital routine. Among schizophrenics the operation was most successful where the symptoms suggest active mental conflict, worst in the hebephrenic group. The best results were obtained in depressive and obsessional patients. Leucotomy should be reserved until all other methods have failed and the prospect of spontaneous recovery is remote. This conclusion was concisely stated in a report by Bennett, Keegan and Wilbur (5), in which detailed case-histories are given for 5 chronic schizophrenics. These authors concluded that the leucotomy operation should be reserved for "chronic and apparently permanent institutional patients in whom any improvement is pure gain and the procedure, even with its hazards, seems justifiable."

Heilbrunn and Hletko (36) report poor results from a group of 10 restless, irritable, noisy, excitable schizophrenics and 1 mental defective with periods of excitement, who had shown psychotic symptoms for 6-32 years. After 9 months only two patients showed some insignificant amelioration of their conditions, and the operation is not recommended in chronic schizophrenia. Tarumianz (91) reports results on 10 cases, 8 involutional melancholics and 2 schizophrenics, all of whom were much deteriorated. Of these, 7 became "fully adjusted socially and mentally . . ." Two studies, by Hutton, Fleming and Fox (42), and Hutton (39) report the results of leucotomizing a group of 50 patients who had made no permanent response to other methods of treatment and for whom the prognosis was bad or hopeless. They describe their results as "encouraging . . . considering the chronicity of many of the cases." Leucotomy was tried in schizophrenic, depressive, obsessional disorders, and for anxiety states. The results are said to be best in the presence of a very strong negatively toned emotional factor, e.g. apprehension, anxiety, inadequacy or guilt; worst in cases of dementia simplex characterized by emotional apathy and general mental reduction. In the later of these papers (39) personality changes after leucotomy are discussed. Though there is considerable variation in the subsequent characters of treated patients, there

are certain characteristic tendencies to be traced in all of them, of which complacency is the most outstanding. Patients are self-satisfied and easily pleased with their environment. They are "not incapable of taking thought for to-morrow should anything stimulate them to do so, but are content for to-morrow to take care of itself." A more detailed description of personality changes following leucotomy is given by Hutton (40) in a careful paper which gives the histories of 10 patients successfully treated by leucotomy, all of whom had a bad prognosis, but who varied considerably in psychiatric diagnosis, age, education, occupation, intellectual ability and temperament. Particular attention was paid to the study of character and personality traits. Records were compiled from the information of relatives interviewed at home, information as to pre-morbid personality being obtained only after illness, operation and recovery. There are disadvantages in obtaining information in this way, especially, perhaps, because of variations in the reliability of different informants. It is, however, important that information should be sought from the patient's home; and depending on the skill of the interviewer, it should be possible to obtain a considerable amount of valuable data. Certain apparently common features were found in the pre-morbid personalities—lack of social adaptation and restriction of personal relationships; the majority were conscientious and meticulous. It seems likely, however, that at least the first two traits would be found in many pre-psychotic personalities, and that they may have no special significance in the pre-morbid personalities of patients who recover after leucotomy. The question cannot be answered with certainty without examining the pre-morbid personalities of a control group whose clinical response to leucotomy is poor. The most obvious feature of the post-leucotomy personality was a diminution of self-consciousness which showed itself variously—in less shyness and reserve; more indifference to adverse criticism; less pre-occupation with bodily functions; sometimes in smugness and self-satisfaction. Accompanying this there is also a decreased awareness of the feelings of other people, expressing itself, for example, in tactlessness. There is a shallowness in the emotional life, no tendency to make new friends and sometimes an absence of old affection. In some patients there is a change in the moral aspect of character, mostly for the worse. The patient is less truthful, less reliable, less scrupulous than in pre-morbid days. The sense of personal responsibility is somewhat reduced, though reaction is normal to immediate situations.

Berliner, Mayer-Gross, Beveridge and Moore (6) and Moore (67) describe the results of leucotomizing 150 chronic psychotic patients, of whom 130 were schizophrenics, mainly aggressive, restless, negativistic paranoids and catatonics. The criterion for the selection of cases was the presence in the clinical picture of signs of mental tension symptoms, e.g. irritability, rage, fear, and motor manifestations such as aggressiveness. Approximately 30 per cent. of the group made a "social recovery," that is, they could leave hospital, live at home under normal conditions, and resume some sort of useful employment, not necessarily up to former standards. About 20 per cent. were classed as "much improved," i.e. these patients have parole, enjoy the amenities of the hospital, and do useful work under supervision. About 6 per cent. are "unchanged," i.e. remain in approximately their pre-operative state; and the

remainder, about 40 per cent., show some degree of improvement within the hospital, or the loss of certain troublesome features of their illness, e.g. violent or impulsive behaviour, faulty habits or destructiveness. It is stated that, within the schizophrenic group, those with the least signs of tension benefit least (6) ; and it is concluded that there is a " remarkable change in outlook for distressful cases of schizophrenia " (67). The best results were on a small group of obsessionals ; and the results in chronic melancholia were also considered encouraging. These latter observations are, however, limited in value because the groups were small. It is pointed out that most of the groups were from the educated classes, and that their better than average pre-morbid personalities may have helped the results.

Ström-Olsen, Last and Brody (89) and Ström-Olsen (88) present the results of leucotomy performed upon over 100 selected chronic patients with a hopeless or very poor prognosis. Approximately two-thirds of the cases were benefited to a greater or lesser extent by the operation. The most favourable outcome is with severe obsessional neurosis, chronic melancholia, and paraphrenia and chronic paranoid states. Parker (68) reports on 100 female patients treated by prefrontal leucotomy. Of these almost one-half were manic depressive (the majority melancholic), and though no exact criterion of clinical recovery is given, it is stated that with all except three cases of manic-depression, prefrontal leucotomy " apparently removed or relieved symptoms of depression, agitation and restlessness almost without exception." Thirty-three of the patients were schizophrenic, and the majority showed no change. Of 19 paranoid illnesses 2 " recovered " and, in general, the patients became less suspicious and more pleasant, though delusional ideas persisted. Parker doubts whether, in schizophrenia, paranoid states and paraphrenia prefrontal leucotomy is more effective than other methods of treatment. Twenty-nine discharged patients were followed up by letters written to relatives, to determine whether these patients could take their place in society. Ten of these patients show a " poor " social adjustment ; the remaining 19 appear to have adjusted on a medium low level. There are no skilled workers among this group, although the relatives and/or the patient are apparently satisfied as regards employment and present personality. In this study, out of 100 patients, 29 per cent. were discharged and, of these, 19 per cent. are apparently a " success."

Frank (17, 18) reviews the results of 200 cases of leucotomy performed on chronic mental hospital patients : average length of hospitalization over 4 years, and over two-thirds working class. The prognostic criteria are taken to be sudden onset ; plasticity of symptom production ; degree of cyclic tendency underlying partial preservation of personality. " Paramount is a conflict situation with emotional colouring." The criteria of clinical recovery are carefully defined. Of the three main diagnostic groups the best results were achieved in the affective group : in this group of 52 patients, about two-thirds involuntional depression, there was a social recovery rate of 69 per cent. The paraphrenic group, consisting of 41 cases diagnosed paraphrenia or paranoia, were " helped magnificently," 61 per cent. of this group achieving a social recovery. Results are quoted as " disappointing " for the schizophrenic group, though " startling individual recoveries " were made, especially in cases

of paranoid schizophrenia. The schizophrenic group consisted of 92 patients diagnosed catatonic, hebephrenic, schizophrenia simplex or paranoid. Twenty-one per cent. of this group achieved a social recovery. Frank considers that the direct effects of the operation on the psychic life are those on the personality. Although the fundamental personality patterns are unchanged there is an emotional desensitization. A poverty or lack of dreams is recorded, and a thinning or disappearance of dereistic experiences: the leucotomized patient cannot day-dream about wishes or be abstractly angry in a sustained fashion. He becomes more plain and matter of fact. Passions and conflicts expressed in the psychosis shift gradually out of focus. He wants to remain in a more or less stereotyped routine of activities.

Frankl and Mayer-Gross (19) followed up 68 patients who had been discharged to their homes. The patients were followed up by a letter of general inquiry. In assessing the replies each statement was tabulated, so that the frequency of each item and a brief picture of each patient was given. Nearly all the subjects (63) replied. The results are considered under various headings: (1) Work and occupation: The professions and housewives showed the best results. More than half the patients could earn their living; more than three-quarters were usefully employed. Over half had the same occupation as before operation; the other half had gone down the occupational scale. There was a greater tendency for occupational deterioration in the schizophrenic group. The frequent change of jobs noted is an interesting feature, possibly due to a general restlessness apparent in other fields of behaviour. (2) Interests and hobbies: Here there are signs of the same restlessness. Most of the group preferred sports or light entertainment, although many had had former serious interests in art, literature, religion or politics. (3) Social life: In contrast to the pre-operative reserve and withdrawal, the patient post-operatively took a definite part in the social life of the community, though there is little individual personal friendship. (4) Family life: The shortcomings of the post-leucotomy personality are more obvious to the family—the shallowness of feeling, self will, temper, etc. Wives and children often feel the emotional estrangement. (5) Sex and married life: There was little indication of irresponsible behaviour; no serious conflict with law and order. (6) Physical characteristics: Changes are often reported—increased weight; greater care of dress; good appetite, sound sleep, etc. (7) Mood: Most striking to the eye, and reported in all 63 letters, is increased self-esteem and lack of self-criticism. From these data the authors sketch the character of a patient after leucotomy. He is physically healthy and cheerful in mood; has a high opinion of self, and may take responsibilities too easily or shirk them. He leads an active life, is restless; has a hobby preference for light entertainment, etc. He is easy going and is a good mixer, though his relations with people round him are often without depth of feeling; he has little sympathy. He is self-willed, and has outbursts of temper. He may attend to work as before or do less well, but thinks he does well: he is not a perfectionist. The picture is modifiable in any particular case by special features traceable to the personality before operation. A weakness in this valuable investigation is that the basic data were gathered by letter, and that no check could be kept upon the reliability of the informants. It is possible

however, that information is spontaneously recorded in a letter which would be suppressed or overlooked in a more structured interview situation. Standardized questionnaires administered by the experimenter in person may be of use when the field has been studied more thoroughly and when more is known of the questions it is important to ask.

Partridge (69) reports on a personal follow-up of 43 cases of patients suffering from affective disorders who were discharged following leucotomy and who were at home. The great majority had resumed former functions, and had proved to be as effective in work as before their illness. Every subject is reported to have shown features of frontal lobe deficit at some time, the commonest symptoms being a lowering of affect and activity facilitated by a lack of restraint.

Garmany (31) reports on 59 cases in whom the operation had been performed not less than three years previously. Each case was examined by the author and, where discharged, a social worker interviewed the family at home. In these latter cases the inquiry was directed to what leucotomy had done to the patient as a social unit, what other people thought of him. Every source of information was tapped. Occasionally an employer was interviewed. A written directive was issued to the social workers indicating the scope of the investigation. The possibility of personality changes was considered in 11 cases of depression which had made successful recoveries. In 9 cases there was no sign of personality change: no inertia, "reasonable and appropriate self consciousness," no lack of social judgment. It was concluded that "reorganization, given adequate time and good surroundings, can progress to the ultimate degree with a restitution that appears to be total." Of 27 schizophrenics (15 hebephrenic, 12 catatonic), only 2 cases were successful. These cases had outstanding home environments. The social efficiency was reasonable in both, the patients being placid, content, and holding down secretarial posts. Of 10 paranoid schizophrenics 5 made a successful recovery. In this series bad prognosis was associated with a high incidence of passivity, early confusional pictures and psychoneurotic onset. It is pointed out that these features correspond with the types of schizophrenia having a bad prognosis apart from leucotomy. Garmany concludes tentatively that in cases of hebephrenia and catatonia it is doubtful whether the operation is worth doing except in special circumstances. The design of this research has much to recommend it, especially in the employment of clearly briefed personnel to help collect the data. The clinical descriptive work, however, is not presented in enough detail for the reader to be able to check the author's conclusions, especially those regarding the outstanding post-operative normality of the affective group.

Ström-Olsen and Tow (90) report upon the late social results of prefrontal leucotomy. The first group (Group C) consisted of 100 chronic, severely disordered psychotics, of whom one half were schizophrenic, the other half diagnosed as paraphrenia, epilepsy, chronic mania, depression. The second group (Group A) consisted of 25 patients admitted specifically for the operation and suffering from neurotic depression, obsessive-compulsive neurosis and chronic, tense hypochondria. Of the C group over 50 per cent were considered purely psychiatric improvements. Using the same standards of grading, all

members of the A group suffered some personality defect. Weighing up the results the authors note that there is considerable nett loss due to the operation. Considering work, pleasure and social status together with the presence of severe anti-social features, psychiatric recovery is often gained at the expense of great reduction in the efficiency, enjoyment and acceptability of the person. Further, the more endowed with higher qualities, the worse is the relative outcome in the end for that particular patient. The only unequivocal indications, it is suggested, are chronic psychosis with severe disorders of behaviour ; and chronic intractable obsessional and depressive states with prolonged and total incapacity. It is not certain in other cases with so-called " specific indications " that there is a nett gain.

(b) *Specialized Clinical Studies.*

A number of researches have been reported in which leucotomy has been performed with a special experimental aim in mind or upon groups or individuals who are in some way unusual. In many cases these studies have not been repeated, and so their importance tends to be limited. Banay and Davidoff (3) report the leucotomizing of a sexual psychopathic personality with a history of masochistic practices. He was operated upon chiefly because of his agitated state and the obsessional-compulsive nature of his ideas. After leucotomy the agitation and sexual phantasies disappeared ; there were no temperamental changes, and the patient seemed to possess insight not apparent pre-operatively. Cohen, Novick and Ettleson (7) considered the effectiveness of leucotomy in the treatment of chronic psychotic overactivity. The experimental group consisted of six schizophrenics who had been ill from 8-28 years, and whose psychosis was characterized by persistent aggressiveness, destructiveness and excitement. One year post-operatively there was some degree of improvement in five of the patients, that is, a reduction in overactivity so that a more satisfactory ward adjustment was possible. Govindaswamy and Rao (32) report on prefrontal leucotomy performed on 25 Indian patients, mostly chronic schizophrenics. In just under half the group there was no clinical improvement after the operation ; 6 patients improved within the hospital environment, and 7 (28 per cent.) recovered, that is, they could adjust in home surroundings and carry out work " as efficiently as could be expected." Reitman (77) made the first experimental study of the autonomic responses of leucotomized subjects. His experimental group consisted of 15 chronic schizophrenics of the excited and catatonic type ; his controls of 5 chronic schizophrenics and 5 other psychotics. He reports that leucotomized subjects show an increased resistance to drugs which upset autonomic equilibrium. Thorpe (92) reports the results of performing leucotomy on two cases of adult post-encephalitic Parkinsonism, in which severe behaviour disturbances present from childhood were removed by leucotomy, " leaving immature but socially acceptable personalities." Two years had elapsed since operation, and both patients appeared to have made satisfactory institutional adjustments. Mackay (56) presents the results of leucotomizing criminal mental defectives who manifested impulsive, violent, self-destructive behaviour. The best

results were in cases uncomplicated by physical disorders, e.g. epilepsy or a post-encephalitic state. Six out of 9 of this group were considered recovered or much improved. Eleven of the 200 cases reported by Frank (17) were categorized aggressive oligophrenic psychopathy—defectives with violent episodes. Seven of the cases were considered improved after leucotomy. Shorvon (86) reports the results of leucotomy on 5 patients in whom depersonalization was fundamental, the predominant and presenting symptom, existing almost alone as a clinical entity. Of the 5 patients, 4 lost their symptoms of depersonalization and the fifth has improved. Jones and McCowan (43) report the results of leucotomizing twelve subjects whose psychosis showed well-defined periodicity. The patients were part of the group of 250 subjects leucotomized at the Crichton Royal, Dumfries, since 1943 (6, 19), and consisted of 9 periodic catatonics and 3 manic-depressives, with an average psychotic history of 14 years. The patients were followed up for $3\frac{1}{2}$ years. Five were considered recovered, and in five there was a marked improvement. The results are considered "strikingly better" than the remainder of the 250 subjects. It is suggested that periodic psychoses are "eminently suitable for treatment by lobotomy." Whether or not these statements are later confirmed by others, this paper must be criticized for its emphatic generalization from the results of so small a group.

Prefrontal leucotomy has been used to relieve the pain of organic disease (27). It is suggested that the operation alters the individual reaction to pain, without materially changing the patient's ability to feel pain. Freeman and Watts (29) described the use of prefrontal leucotomy in the modification of childhood schizophrenia. Of eleven individuals whose schizophrenia developed before the age of ten years but who were not all operated upon in childhood, only one is "able to assume responsibilities commensurate with his age, or intellectual attainments." Despite these results, and in view of the poor prognosis without operation, Freeman and Watts feel encouraged to continue with certain patients of this type.

(c) *Pathological Studies.*

A major contribution to the literature of prefrontal leucotomy consists in the pathological studies of Meyer and Beck (61), Meyer, McLardy and Beck (63), Meyer and McLardy (62) and McLardy and Meyer (58). In an early paper (61) the available material consisted of 7 histologically investigated cases of prefrontal leucotomy and 1 case of frontal lobectomy in a mentally normal patient. Certain interesting points emerged. Two cases showing a "notable degree of recovery" were patients with little or only moderate deterioration. During the decisive period following the operation there were no clinical complications to interfere with recovery. The operation itself produced circumscribed lesions uncomplicated by severe haemorrhage and softening of any appreciable extent. Of three unrecovered cases, one was "severely deteriorated"; in one the cut was too posterior, and extensive haemorrhage had destroyed a considerable part of the white matter. In the recovered cases it was "surprising how little damage was sufficient to produce

remarkable clinical improvement." The cut may be incomplete in severing the thalamo-frontal tract. "It follows that in suitable (non-deteriorated) cases a good recovery may follow rather surprisingly incomplete and circumscribed cuts in the white matter of the prefrontal lobe. In a similar type of case recovery may be prevented by an excessive lesion either by cutting in too posterior a plane or by causing extensive haemorrhage."

Meyer, McLardy and Beck (63) reported on 28 patients, average duration of illness eight years, who had lived over seven weeks post-operatively. The first sub-group consisted of nine patients who "showed substantial improvement" and survived over six months. They consist in the main of cases of manic-depressive or other affective disorder. The second sub-group consisted of nine patients who were unimproved but who lived over six months post-operatively; the third sub-group of ten patients who were unimproved and lived under six months. Most of this last sub-group died from the delayed effect of the operation. A number were "improved," i.e. lost certain psychotic manifestations, but this was offset by highly undesirable symptoms such as an extremely severe frontal lobe syndrome (manifesting itself in fatuous euphoria, inertia or restlessness); hyperkinetic movements; trophic disturbances, resulting in skin eruptions; persisting incontinence; disturbance of speech. The involvement of the white matter is far more complete than in the other two groups, and it is not confined to the prefrontal region. There is a striking incidence of striatal involvement. Damage to area 6 is not conspicuous, but there is always the possibility that cuts extending into the striatum may sever fibres connecting with this area. It is possible that the involvement of these regions accounts for at least some of the motor and autonomic post-operative sequelae.

These findings were followed up (62) in a clinico-pathological study of posterior cuts in prefrontal leucotomy based on 40 cases. The usual leucotomy cut remains entirely within the prefrontal region, but the cuts are sometimes more posterior. Personality change, graded according to severity, tends to be most severe when posterior lesions are most widespread. It is, however, not dependent upon (though amplified by) damage to the posterior regions of the frontal lobes. Personality change also occurs after lesions confined to prefrontal regions proper. "That personality change becomes more severe in posterior cuts may simply signify that the prefrontal connections have been more completely cut off."

In a later paper (58) an attempt was made to answer specific questions, i.e. (1) Is any attribute common to the lesions a pre-requisite to clinical improvement? (2) Does the degree of improvement vary with any qualitative or quantitative feature of the lesions? (3) Does any relationship revealed between the lesions and improvement hold good in equal degree for each of the main types of functional psychosis? Three rough clinical groups were defined: The first group consisted of predominantly affective conditions: 15 patients of whom 11 were improved, 4 unimproved. The second group consisted of mixed, mainly paranoid psychoses: 12 patients, 6 improved, 6 unimproved. The third group consisted of 13 schizophrenics: 5 improved, 8 unimproved. In a gross comparison between the improved versus the unimproved cases no evidence

was found of any segment of white matter the bilateral involvement of which is indispensable to improvement. The central segment comes nearest to being such a region. There was, however, a greater average total number of segments involved in the improved cases than in the unimproved. Further, the severity of the post-operative personality change varies directly with the total number of segments involved. In this series of cases, therefore, post-operative personality change would appear to have the same anatomical correlates as has the clinical improvement. Comparing the diagnostic groups, in the affective and paranoid groups the more improved cases have on the average more posteriorly placed cuts. The improved cases of the schizophrenic group in general have a more extensive isolation of the prefrontal cortex when the plane of the cuts and their extent are considered together. These findings point to one general principle, namely, clinical improvement varies, among cases of equally moderate prognostic potential, directly with the total amount of prefrontal cortex isolated from its white matter. At the same time fibres which run in the central segment seem to be those whose cutting matters most. This would still be in conformity with a quantitative principle, since thalamic fibres to and from all other segments tend to collect in this central region. Its full involvement in a posterior plane will sever most of the fibres coursing between the thalamus and prefrontal cortex. In progressively more anterior cuts the fibres travelling in it will become progressively more only those connecting with regions near to the frontal pole (areas 10 and 46 and the anterior parts of areas 9, 11, 12, 47 and 32). In cuts in the middle plane (the commonest plane of cut in the best improved cases) such rostrally connected fibres will already constitute a high proportion of the fibres in the central segment. It may be that with cases of better prognostic potentiality more circumscribed and more rostral lesions may well constitute the optimum amount of damage.

(d) *Studies Using Modified Operative Techniques.*

In an attempt to effect the desired psychiatric and social changes while avoiding the undesirable sequelae of prefrontal leucotomy as practised by Freeman and Watts (23) or minor variations of this technique (57, 96 and others), modified operative techniques have been devised. Attempts have been made to limit the transection of the prefrontal lobe to the orbital areas alone. Dax and Radley-Smith (10, 11) and Reitman (78, 80) have reported over 200 cases, in some of whom the low vertical or "orbital" cut was attempted; on others a full leucotomy was performed. In an early paper (10) 50 cases were reported a "short time" after operation. These were the most disturbed patients in the hospital. Sixty per cent. were paranoid reaction types, mostly paranoid schizophrenics. Of the remainder, half were deteriorated schizophrenics, half were manic-depressive, either chronic mania or agitated depression. The "active" symptoms improved: the patients became less violent, hostile, noisy, etc.; the "passive" characteristics, worry, depression, pre-occupation, delusions, etc., failed to benefit. In approximately one-third of the cases there was "considerable improvement," one-third were "moderately better," and in the remainder there was little change. Dax and Radley-Smith

(11) report the effect of varying the position of the brain sections, methodically working down to the orbital cortex. A group of 125 cases classified as gross conduct disorders, the majority long-standing psychotics, showed 9 per cent. "good" results, 42 per cent. "fair," 46 per cent. "poor." A group of 54 non-chronic patients showed a 37 per cent. good, 37 per cent. fair, and 22 per cent. poor post-operative clinical status. An analysis of the cases is presented according to the type of incision, and suggestions are given as to the type of syndrome affected by different incisions. In view of the pathological evidence of the unintentional variability of the cuts in consequence of a "blind" leucotomy operation (62), it would seem necessary to interpret the suggestions from this analysis with caution until the claim to be able to place incisions with accuracy, a claim fundamental to, and implicit in, the suggestions, has been substantiated from the post-mortem examination of a sufficient number of brains.

A follow-up study of 60 patients is reported by Reitman (80). The patients had been out of hospital between six months and $4\frac{1}{2}$ years and represent a discharge rate of 24 per cent. Assessment of the results was by (1) questionnaire; (2) letters from the patient and from relatives; (3) visit of a social worker; (4) psychiatric interview. Patients were grouped into "better than fair recovery" and "fair recovery," and statistical analyses were undertaken to determine the relationship between this dichotomy and other dichotomized variables. Sex, civil status and duration of illness were insignificantly related to post-operative status; the relationship between age and post-operative status was significant at the 5 per cent. level, patients under 45 years tending to be in the "better than fair" group. Single persons tended to fall in the "better than fair" group more often than those who were married, but it is suggested that the relationship is probably accounted for in terms of the age factor. When the group was divided into two sub-groups, the first sub-group characterized by the low vertical or "orbital" cut, the second group by cuts "other than orbital," the discharge rate for the whole group of 250 was significantly higher (at the 1 per cent. level) for the low vertical cut. Within the discharged group 64 per cent. had the orbital cut. Reitman notes that the significance of the superiority of the orbital cut is independent of duration of illness or of age.

Hofstatter, Smolik and Busch (37) report results obtained using an "orbital" cut. The patients were psychotics, average length of illness 10 years, many of whom showed social maladjustment and anti-social behaviour on a noisy, combative and destructive level. The post-operative recovery rate of 40 per cent. the authors state is at least equal to the results obtained with the full leucotomy. Of the best results they state: "the patients . . . show resourcefulness, common sense, interest and planning for the future. . . . Their pathological personality trends are now only faintly recognizable" Egan (12) reports the use of an orbital technique on a group of 52 chronic patients, mostly schizophrenics, average duration of illness 10 years. Of those patients living outside hospital, 26 of whom have lived outside for over two years post-operatively, 11 are gainfully employed; 6 are fully occupied in their own homes; 4 take full housekeeping responsibilities; 8 are

idle. The discharged subjects were followed up by letter. They are reported as cheerful, optimistic, pleased with their condition. Relatives comment upon their happy, carefree disposition. Restlessness and hyperactivity are shown in frequent changes of employment and diversity of interests. The patients are sometimes described as difficult to live with. The group of 100 patients described by Berliner *et al.* (6) was used for comparison of the results by the present technique and that using the standard procedure. The crude rate of recovery is lower than that of Berliner (45 per cent.), but the difference is not statistically significant. The recovery rate is, however, significantly lower in the paranoid group—respectively 22 per cent. and 50 per cent. Egan concludes that in certain cases the isolation of a larger area of frontal cortex than the orbital regions is needed for the satisfactory relief of psychosis. The clinical results are less favourable than with the coronal section, especially in the paranoid and obsessional groups.

A further modification of the leucotomy technique consists in the trans-orbital leucotomy (20), in which an attempt is made to sever the thalamo-frontal radiation fairly far anteriorly without disturbing the cortex except to a minimal degree. Freeman performed the operation on 10 patients with "encouraging results": after two years six were fully restored. The series was extended to 100 cases. Describing the results, it is said that general and undesirable changes in personality are usually minimal. Occasionally there is some indolence and tactlessness. The only thing lacking is said to be a certain subtlety and insight into the subject's own mental mechanisms. Personality tests have revealed "richness and depth" in post-operative personalities. Details of the tests are not given. Response to the operation depends on the previous personality, and upon the type and the severity of the illness. The worst patients show little change. Anxiety and emotional tension are often overcome; depressive ideas, phobias and obsessive thoughts usually improve; fixed delusions and hallucinations are rather resistant; motor compulsions and tics may continue unchanged. Emotional dilapidation is the chief contraindication. Fleming and Phillips (16) report the use of transorbital leucotomy upon 8 cases, 5 of depression, 2 paranoid, 1 catatonic, whose average duration of illness, was three years. Two of the patients recovered completely, 5 were improved. These results appear promising, but little comment can be made until further studies are reported in which the clinical description and post-operative follow-up is on a level comparable with that reported in the most careful of the studies previously reported.

A modification of major importance in leucotomy technique is the "open" method described by Worchel and Lyerly (97) and modified by Poppen (73). Worchel and Lyerly state that the open procedure is "more complete and probably more effective" than that of Freeman and Watts. It would seem, however, that on a basis of 13 cases of agitated depression or involutional melancholia described in their paper, this statement may be premature. The open method is, however, anatomically preferable to blind methods (4); as there is direct visual control, there can be more certainty of the fibres cut. Moore, Friedman, Simon and Farmer (66) report on the use of the Lyerly or open technique for nearly all the 200 subjects in the co-operative clinical study

by the Connecticut Lobotomy Committee. The sections were done conservatively rather than radically. Definitions of diagnoses, personality description, symptoms, and criteria for evaluating results were agreed upon by all members of the team. A common protocol was used for recording the data in a standard manner consistent with the definitions. Clinical descriptions of each subject and follow-up notes were made 1, 3, 6 months and 1 year post-operatively. The great majority of the subjects (163) were schizophrenic. Ninety per cent. had been hospitalized for one year or more, the mean length of hospitalization being five years. The pre-operative intelligence distribution of the group showed a slight concentration at the extremes of the curve. After three months 36 per cent. of the whole group were slightly improved, unimproved or worse; 36 per cent. were moderately improved; 24 per cent. were markedly improved or symptom-free. At the end of the year the picture changed in the direction of continued improvement. The authors state that the paranoid group of illnesses has the best prognosis, catatonia next, hebephrenia the poorest. The non-schizophrenic group tend to do better than the schizophrenic group but, after three months, the difference in the recovery rates is insignificant. Sex and intelligence may be ignored as prognostic criteria. The more troublesome symptoms, e.g. anxiety, depression, hypochondriasis, impulsiveness, destructiveness, were eliminated in 75 per cent. of the cases. The authors consider frontal leucotomy to be "a highly effective procedure for the treatment of intransigent mental disorders."

The research provides no evidence, however, that the Lyerly technique gives clinical results superior to those of the blind leucotomy. It remains for future research to determine whether the results in individual cases, especially, perhaps, those cases which make a "social recovery" after the operation, are better than those of other techniques. Poppen (73) reports on 470 cases operated upon by the modified Lyerly technique. Good results were achieved with 20 per cent. of the schizophrenic group, who were able to return to work and to make a living. A fair degree of improvement was achieved in 37 per cent. of this group, there being symptomatic improvement, making the patients easier to manage. In 40 per cent. of the group the condition was unchanged. A group of involutional melancholics showed good results in 55 per cent., fair results in 33 per cent. "Gratifying" results are said to have been obtained on a group of agitated depressives. No details are given. The author comments that neither duration of illness nor age are important factors compared with existing degree of tension, anxiety, fear and self-concern.

(e) *Summary.*

The main points which emerge from a review of the *clinical studies* of prefrontal leucotomy are: (1) Approximately 25 per cent. of *schizophrenics* can be expected to make a "social recovery" after leucotomy. This figure is based mainly upon researches which include large groups of schizophrenics (17, 18, 66, 73). It is supported by the studies of McGregor and Crumie (54, 55), Govindaswamy and Rao (32), Egan (12). The validity of this figure is subject to the limitations of all such statistics derived by combining the results of several leucotomy researches: the proportions in each schizophrenic

clinical sub-type are not the same in each research ; several different operative techniques are included ; the judgment of post-operative clinical status varies from one research to another. The effect of varying one of these factors can be seen from an example : Freeman and Watts (28) include paranoid illnesses in their schizophrenic group. They report that 46 per cent. make a " good " recovery, which is considerably higher than most other authorities.

(2) Probably the best results are obtained in the *affective disorders*—involuntary melancholia, agitated depression. From studies in which large numbers of subjects were examined, " social recovery " or " good recovery " is reported in from one-half to two-thirds of the cases (28, 17, 18, 73). These figures have been confirmed in several smaller studies (87, 54, 55, 91).

(3) *Paranoid illnesses* are usually considered to respond better to leucotomy than other schizophrenic illnesses, but not as well as the affective disorders (17, 18, 89, 6, 67, 10, 66).

(4) *Obsessional disorder* is said to respond well to leucotomy. Freeman and Watts (28) report that 61 per cent. of their 51 cases made a " good " recovery. Other authorities agree that results from obsessionals are very favourable, but in most cases the numbers in the groups upon which these opinions are based are small (76, 6, 67, 89). The evidence must be regarded as inconclusive, and the response of this disorder to leucotomy decided when larger numbers have been operated upon.

(5) Other contexts in which the psychiatric results of leucotomy have been reported as favourable are : in controlling the violence and impulsiveness of selected *mental defectives* (17, 56) ; in reducing chronic psychotic *overactivity* (7) ; in abolishing the *periodicity* in certain psychoses, especially catatonia (43) ; in removing the symptoms of *depersonalization* (86).

(6) Many workers have stressed that psychiatric diagnosis, as such, is of less importance in selecting cases which will respond well to leucotomy than certain specific indicators in the symptomatology of which *emotional response* (presence of apprehension, tension, anxiety, depression, agitation, hypochondriacal ideas, etc.) is considered by many to be the most important criterion of selection (76, 25, 20, 70, 42, 39, 6, 46, 67, 17, 18, 8, 66, 45, 73, 33, 83).

(7) Follow-up studies of patients treated by leucotomy almost invariably report that certain *personality changes* have followed the operation. Robinson, Freeman and Watts (82), from a study of minimal, standard and radical lobotomies and transorbital leucotomy, state that all patients show some lack of personality depth after leucotomy. In varying degrees they are cheerful and complacent, and sometimes indifferent to the opinions and feelings of others. Hutton (40) considers the chief features of the group followed up by her to be a diminution in self-consciousness showing itself in less shyness and reserve, more indifference to adverse criticism, etc., and, accompanying this, decreased awareness of the feelings of others, which shows itself in tactlessness and shallowness in emotional life. There is no tendency to make new friends, and sometimes an absence of old affection. Frankl and Mayer-Gross (19) report an increase in self-esteem and lack of self-criticism to be the most consistent finding from all their cases. Egan (12) reports patients post-operatively to be cheerful and optimistic, restless, and sometimes difficult to live with.

II. STUDIES USING PSYCHOLOGICAL TEST TECHNIQUES.

(a) *Cognitive Tests.*

It has been claimed by some investigators that there are no changes in formal tests of intelligence following prefrontal leucotomy. In several such investigations it is impossible to check the validity of the claim, either because the intelligence tests used are not specified or numerical results are not given (64, 87, 55, 14, 39, 17, 86, 30).

Thorpe (92) reports a rise of a few points of score on Raven's Progressive Matrices Test administered to a single patient before and after leucotomy. Other tests were administered, sometimes to several patients but only post-operatively; therefore no conclusions can be drawn as to the effect of prefrontal leucotomy upon intelligence. Worchel and Lysterly (97) administered the Stanford-Binet to five psychotics, cases of affective disorder, before and after leucotomy. Numerical results are not given in the paper, but it is said that there were almost identical pre- and post-operative responses to each individual test item. The slight changes were not significant or consistent. Hunt (38) included Kohs Blocks in her battery of intelligence and personality tests given to 40 subjects, varied in age, sex and psychiatric diagnosis, before and two weeks after leucotomy. This test showed no change post-operatively. Ström-Olsen *et al.* (89) administered a variety of formal intelligence tests to 11 chronic patients before and six weeks and four months after leucotomy. As the authors present no statistical evaluation, the results at the first retest from the more important of these tests were analysed for significance by the writer (Table I). Changes on all tests were quite insignificant. The study included

TABLE I.—*Changes in Scores on Eight Cognitive Tests after Leucotomy.*(Data from Ström-Olsen *et al.*, 89). N = 11.

	Pre-leucotomy mean.	Post-leucotomy mean.	<i>t</i> ratio.	Level of probability.
Terman Vocabulary (mental age)	15·182	15·091	0·363	0·700
Stanford-Binet Form L (I.Q.)	94·273	92·091	0·529	0·628
Raven's Progressive Matrices (I.Q.)	87·273	90·000	—0·846	0·442
Porteus Mazes (mental age)	12·000	12·136	—0·160	0·845
Kohs Blocks (mental age—months)	151·818	159·636	—1·275	0·223
Alexander's Passalong Test (mental age—months)	143·091	159·364	—1·476	0·165
Shipley Vocabulary (mental age—months)	182·182	170·273	1·584	0·141
Shipley Abstractions (mental age—months)	146·909	152·182	—1·283	0·223

verbal tests (Stanford-Binet, Terman Vocabulary, Shipley Vocabulary, Shipley Abstraction), performance tests (Kohs Blocks, Alexander's Passalong Test, Porteus Mazes), and a non-verbal intelligence test of the perceptual type (Matrices). This study provides perhaps the main experimental support to

the view that there are no significant changes in formal tests of intelligence following leucotomy. Jones (44) included the Porteus Mazes, the Goodenough Drawing-a-Man Test and digit span in his test battery administered to 24 chronic schizophrenic patients before and after leucotomy. Scores on the Porteus Mazes increased insignificantly; scores on the Goodenough Test and the digit span increased significantly post-operatively. In addition the Wechsler scale was administered to two subjects. There were losses of seven and four I.Q. points three weeks after operation, both losses occurring because of verbal rather than performance sub-test decrements. However, after three months both subjects had regained their small losses and scored a few points above their pre-operative I.Q.

Contrary to these results several investigators support the view that scores on certain formal tests of intelligence decrease after leucotomy. Porteus and Kepner (74) gave to 17 psychotic patients, heterogeneous as regards I.Q. and degree and type of psychosis, the Porteus Maze Test, and to 18 subjects a modified Stanford-Binet Test. This test was a composite of forms L and M in which lesser emphasis is placed on verbal sub-tests. Scores on the Binet test decreased after leucotomy, but the decrease was insignificant. The actual statistics computed from Porteus' data are given in Table II. Changes in

TABLE II.—*Changes in Binet I.Q. after Leucotomy.*

(Data from Porteus and Kepner, 74.) N = 18.	
Pre-operative mean I.Q.	= 83.889
Post-operative mean I.Q.	= 80.667
<i>t</i> ratio	= 1.386
Level of probability	= 0.179

scores of the experimental group on the Porteus Mazes after leucotomy were compared with those of a control group of 17 cases all over fourteen years of age, drawn at random from the clinic files, who had had repeated applications of the maze. Of the clinic cases 71 per cent. improved on the second testing, the average gain being 1.94 years. Of the leucotomy cases 6 per cent. improved on the second application, the average loss of the group being 1.97 years. The assessment of the significance of these changes by orthodox statistical techniques is not reported by Porteus. In a later research, however, Porteus and Peters (75) report the results of testing 55 patients on the maze test before and after leucotomy. From the case-histories of these patients it appears that they are a sample drawn from a psychotic population very similar to that of the earlier research. Combining the two groups to form one group of 72 subjects, the significance of the difference in scores before and after leucotomy was computed, for this group, by the present writer. The results are given in Table III (A). The drop in scores after leucotomy is statistically highly sig-

TABLE III (A).—*Changes in Mental Age on the Porteus Maze Test after Leucotomy.*

(Data from Porteus and Kepner, 74; Porteus and Peters, 75.) N = 72.

Pre-operative mean M.A.	= 11.312 years.
Post-operative mean M.A.	= 9.583 years.
<i>t</i> ratio	= 6.500
Level of probability	= <0.01

nificant. A group of 55 criminals (resembling in age, social status, intelligence and racial composition the experimental group in the investigation by Porteus and Peters) was tested and re-tested on the maze test, though at a much longer interval. Sixty-nine per cent of this group showed gains on retest compared with 27 per cent. of the experimental group. The authors note that practice effects which are not apparent with the patients a short time after leucotomy appear with criminals even after years. It seemed possible, however, that the results reported by Porteus and his collaborators had been exaggerated by the fact that in both investigations many of the subjects had been tested very soon after leucotomy. To check this, the present writer abstracted from the 72 patients tested on the mazes by these authors 23 patients on whom the first retest after leucotomy was three months or more after the operation. These figures were tested for statistical significance. The results are given in Table III (B). It will be seen that the differences in test scores following leucotomy are still highly significant.

TABLE III (B).—*Changes in Mental Age on the Porteus Maze Test after Leucotomy. First Re-test Three Months or more Post-operatively.*

(Data from Porteus and Kepner, 74; Porteus and Peters, 75.) N = 23.

Pre-operative mean M.A.	= 10.413 years.
Post-operative mean M.A.	= 9.000 "
t ratio	= 3.233
Level of probability	= <0.01

Robinson (81) administered the Porteus Mazes to 7 leucotomized subjects and to 7 controls matched on diagnosis and vocabulary. She found that the leucotomized subjects scored reliably lower than the controls. Koskoff *et al.* (53) studied 7 subjects psychometrically before and after prefrontal leucotomy. The study is especially interesting, as the group was operated upon for the alleviation of pain. Pre-operatively members of the group suffered from no functional or organic brain disorders. They were retested three months post-operatively. On the Wechsler Test, full scale, 5 cases showed an average decline of 20.4 I.Q. points—from 87.2 to 66.8. This difference is statistically highly significant. Further, whereas the average verbal I.Q. declined 16.1 points, performance I.Q. dropped only 7.9 points.* Interestingly in view of this result, scores of four subjects on the Terman-Merrill Vocabulary showed no consistent change. The scores of 3 patients tested with the Porteus Mazes all declined, the average decline being 4.1 years. Malmö (59) included certain formal intelligence tests in the battery which he administered to small groups of patients before and after frontal gyrectomy and frontal lobotomy. A group of 6 patients, including one gyrectomy, were given the Wechsler. All the I.Q.'s were lower after operation, the average drop being 8.33 I.Q. points, from 107.8–99.5, which is significant at the 5 per cent. level. Stanford-Binet Vocabulary scores showed consistent losses on the lobotomized group. The mean pre- and post-operative difference for a group of 6 lobotomy

* Koskoff notes that the post-operative average verbal intelligence was based on five cases, the average performance intelligence quotient was based on six cases, and that these average quotients were not derived from identical cases. He feels, however, that the direction of the change in intelligence, if not the extent, represents a reliable change.

cases and 3 gyrectomy cases was reliable at the 2 per cent. level. Similarly on the Capps Homograph test (a form of vocabulary test in which the subject has to give various different meanings for the same word) definite reductions in score are reported following frontal lobe operations. Of 7 lobotomized subjects the scores of 5 decreased on the Porteus Maze Test ; 2 gained slightly in score. These results are considered as not in disagreement with Porteus.

Rylander (84) applied psychological tests before and after leucotomy to small groups consisting of 1, 2 or 4 patients. No exact statement of results is given. Four subjects were tested with the Binet. The differences were not large, but there was reduction of I.Q. in every case. Despite repeated testings, I.Q.'s do not reach the pre-operative level. Various other tests were given, but it is difficult to interpret the results. There are too few cases, and no exact statement, or statistical evaluation, of the results. Yacorzynski *et al.* (98) made a careful psychometric investigation on a single individual, tested before and after leucotomy. Of the intelligence tests given, the I.Q. on the total Wechsler scale decreased from 104 to 87, and the decrease on the verbal scale (111-89) was greater than that on the performance scale (94-86). The Binet test decreased from 118-97. Petrie (71) used the Wechsler Scale and the Porteus Mazes as the main cognitive tests in her investigation of 20 severe neurotics tested before and 2-3 months after leucotomy. The patients are described as depressed, anxious obsessional or paranoid. A mean loss of over 7 I.Q. points on the Wechsler verbal scale was found, this decrease being significant at the 5 per cent level. There was no significant drop on the performance scale. On the Porteus Mazes there is a mean loss of 1.82 years of mental age at the three months' re-test which is significant at the 5 per cent level.

(b) *Special Investigations.*

Several of the tests given by Hunt (38) could be scored for speed and accuracy. These were : the Cube Construction Test ; arithmetic test ; a substitution test (key with 6 symbols, to which have been assigned the first 6 digits. Beneath the key is a list of symbols with blank spaces for inserting numbers) ; spatial test ; colour naming (100 patches of colour. Five sample patches at the top for practice. Subject to name colours represented in the 100 patches). On these tests the speed scores showed reliable changes, but the direction of the speed change is not consistent. The author comments that the changes showing a decrease in speed are more reliable. Seven patients were tested several months post-operatively, however, when the loss in speed was largely regained. The Kent-Rosanoff Word Association Test was given two weeks post-operatively. Subjects took a longer total time to do the test, but there were fewer extremely delayed responses ; fewer failures to respond ; fewer peculiar responses ; fewer responses of a self-reference type ; less perseveration ; and less objection to taking the test. The Bernreuter Personality Inventory was given to 7 patients. The largest changes were decreases in neurotic tendency and introversion. Other statistically reliable changes were on the Match Stick Test (ability to reproduce designs from memory) and the Coin under Cups Test (ability to identify cups under which coins have been placed after a

short interval). On both these tests there was a better performance post-operatively. On a cancellation test there was a reliable increase in accuracy. On the Rorschach Ink Blots the subjects showed more restricted and constricted records post-operatively. The quantitative changes in the records are generally small. In summary they consist in a further constriction of personality shown in decreased R, Z and M responses ; greater extratensive tendency shown by a change in the M : Sum C ratio ; a slight loss in organizational, synthesizing and related higher intellectual tendencies, shown, for example, by a change in the manner of approach : there is a shift of emphasis on the W post-operatively, which, in subjects of relatively low intelligence, is considered probably indicative of loss of synthesizing ability post-operatively ; there is a larger percentage of "normal" or "popular" type responses post-operatively. Of the qualitative signs, post-operatively there is less response perseveration ; less self-reference ; less concern over performance and less self-criticism ; a shift in attitude toward the experiment from one of predominantly high affect and pained constraint and reluctance to one of apathy ; there are fewer indications of neurotic trends. Six subjects were tested again 3-12 months after operation. These records are considered "better" on the whole than the two-week records. They show a general expansion, greater indication of intellectual adequacy, fewer indications of abnormality. There is an increase in the total number of responses, better distribution of W-D-d-S responses, more movement, a better proportion of good form responses, a more normal number and distribution of colour responses. Qualitative aspects include an absence of perseveration, and an improvement in attitude towards the test and the absence of excessive self-reference.

Kisker (51) made pre- and post-operative Rorschach analyses on a few cases. He notes the lack of quantitative change of scoring signs, and that qualitative changes are not large in most cases. In general he concludes that the neurosurgical transection of the frontal association areas plays a less important role in the reorganization of Rorschach patterns than does the pre-psychotic and pre-operative personality structure. Other psychological test procedures were carried out on 20 subjects (48, 47, 49), though numerical results are not given in these articles. It is concluded, first, that there are no important intellectual defects. Second, defects in abstract and categorical thinking do not make themselves felt in any important way in the total personality picture. This conclusion is based upon experiments of a qualitative type (49). Tests used included Kohs Blocks interpreted qualitatively, the Weigl-Scheerer-Goldstein Colour-form Sorting Test, Halstead's Grouping Behaviour Test and the Rorschach Test. Third, an analysis of linguistic form and meaning relationships was made using the word association technique, a sentence construction test and the analysis of syntactical relationships. No linguistic form of semantic trend was found to be characteristic of the post-leucotomy patients. Fourth, investigations were undertaken in the perceptual-motor field (47) in an attempt to determine both experimentally and on a basis of general observation the degree of disturbance present in the series of 20 leucotomized patients. The Luria tremographic technique was used to study psychomotor pattern. Post-operatively the clinically improved patients showed definite alterations in motor organization in the direction of more stable and symmetrical responses.

The unimproved patients either showed no changes or changes in the direction of better motor organization resembling those seen in clinically improved patients. Kisker suggests that this latter group had in some manner profited by leucotomy, but conditions were such that overt improvement was not possible. This explanation is unconvincing, but in the absence of data from which the statistical significance of the various changes in test results can be assessed, no criticism is possible. Visual motor patterns were studied using modified Wertheimer patterns of varying complexity. The effect of the operation on the memory trace system of the patients was studied. The reproduction of the designs and the subsequent analysis of the reproduced material, with particular emphasis on gestalt principles, failed to reveal widespread impairment of so-called gestalt function. The motor components of speech and gait remained unchanged as a result of leucotomy. In a few patients apraxic and agnosic phenomena were observed, but these were atypical. These disturbances showed themselves in tests of "constructive praxis," drawings, reproduction of designs, etc. The gnosis study was negative. Leucotomy, it is concluded, has no appreciable effect on elementary motor integrative functions. This is true for all the tests. While the operative group showed pre-operative and post-operative motor irregularities, and the improved patients less pronounced irregularities post-operatively, the pattern of motor integration approximates to that of psychotic patients in general.

Schrader and Robinson (85) attempted to evaluate the post-operative improvement of 16 chronic schizophrenics using the Gardner Behaviour Chart. This chart rates the patient on 15 categories easily observable by nurses and attendants, e.g. appetite, sociability, work capacity, care of property, etc. Degrees of behaviour in each category are defined for the rater and are scored 0-1-2-3-4. One advantage of this procedure is that it permits the rating of untestable subjects. The mean score for the entire Gardner chart and for the whole group increases significantly after leucotomy, i.e. as judged by the Gardner indices leucotomy has produced a reliable improvement in the patient's behaviour. Various types of behaviour did not improve equally. Care of property, work capacity, work initiative improved least; sociability, appearance, various types of self control of behaviour with relevance to the situation improved most. Jones (44) also used a ward behaviour chart to provide evidence of patient improvement. Behaviour chart variables were rated in terms of a four-point continuum, each point representing a behavioural description. Specific variables on which significant improvement is shown vary slightly from one post-operative retest to the next, but the important finding is that total adjustment scores suggest that overall behaviour does not improve after the eighth week. Orientation questions regarding marital status, home town data, pre-hospital occupation, and telling the time from a watch reflected significant improvement post-operatively.

Robinson (81) tested the hypothesis that there is a loss of the capacity for prolonged attention after leucotomy. The cognitive aspect of this capacity she tested by deliberation tests, consisting of making rhymes and doing simple mental arithmetic. The combined test showed that compared with matched control groups the leucotomized subjects suffered a definite intellectual deficit

in a function which she calls prolonged attention. This finding was confirmed in a later study (82). The motor aspect of prolonged attention she tested using three of the Downey Will-Temperament Tests—speed of decision, volitional perseveration (disguised handwriting), and motor inhibition (slow writing). On the three tests combined the leucotomized subjects did significantly less well than the controls. The author feels that the factor common to deliberation tests and the Downey Tests is one of deliberativeness or capacity for prolonged attention, and that this is diminished by prefrontal leucotomy. It is difficult to judge this experiment in isolation, as the significance of the results depends largely upon the results of research into the psychological nature of deliberativeness, if such a quality exists, and whether, if it exists, it can be validly measured by the tests described.

Halstead *et al.* (35) and Halstead (34) attempted to measure the psychological deficits following circumscribed brain lesions. He develops the concept of "biological intelligence," which he considers a kind of intelligence of fundamental importance, but different from that reflected by standardized psychometric tests. A four-factor description of biological intelligence is given, which is based on a factor analysis of the intercorrelations between 13 neuropsychological indicators administered to 50 healthy adult males regarded as medically recovered from a recent concussive type head injury. These factors are, first, a central integrative field factor which is described as representing the organized experience of the individual. Some of its parameters, it is suggested, may be reflected in measures of psychometric intelligence. Second, abstraction, the basic capacity to group to a criterion, which involves the comprehension of essential similarities and differences. Third, a power factor, a dynamic factor reflecting the over-all status of the brain. Fourth, a directional factor, which is the medium acting as direction or outlet for the exteriorization of biological intelligence. Halstead attempts to localize these basic factors in the cortex. Tests are examined to determine which of these differentiate between groups of neurotic patients without head injury, and head-injured patients without neurosis. The ten best tests are used to form an impairment index. Score on this index differentiates significantly between controls, frontal lobectomy and non-frontal lobectomy groups. The mean impairment index for frontal lobectomies is six times that of normals and three times that of the non-frontal lobectomies. Halstead concludes that the impairment index reflects brain functions, and specifically functions which have their maximum representation in the frontal lobes. Leucotomized patients show no significant change in the impairment index before and after operation. Biological intelligence as reflected by the impairment index is not significantly altered by prefrontal leucotomy. It is suggested, in explanation of this finding, that the biological intelligence of the leucotomy patients was impaired prior to operation, and that leucotomy produced no consistent change.

The main points of criticism of this research are, first, that the central concept, "biological intelligence," is discussed but not defined nor clearly differentiated from other more generally accepted concepts of intelligence. Second, the number in the group (50) is small, and the number of factors extracted (4) is such as to throw doubt on the statistical significance of at

least two of the factors. Third, the identification of the factors is based in each instance on very few significance loadings. These criticisms are made because the factor analysis is fundamental to the description of biological intelligence. An elaborate theory is built on a basis which appears statistically unsound. It must be agreed with Zangwill (99) that "all that has been established is that cases of unilateral frontal lobectomy show significant impairment on an arbitrarily selected battery of psycho-physical and mental tests."

A special investigation of a qualitative type was carried out by Reitman (79), in which he studied the "creative spell" of schizophrenics after leucotomy. He notes that the schizophrenic personality is changed after leucotomy, and suggests that personality changes are reflected in the artistic activity of the patients. He makes an attempt to evaluate the personality changes in connection with the artistic products of two patients. In one patient the operation activated a creative spell of typical schizophrenic art; in the second case, that of a music teacher of high intelligence, her musical compositions appeared to reflect her post-operative mentality. The factor common to the two forms of activity is that the creative spell is activated or modified by the operative brain injury. Typical features are the disorganized form sense, the chaotic appearance, and the rapid development towards organized form tendencies and towards normal symbols and patterns.

Hutton and Bassett (41) have investigated the effect of leucotomy on the creative personality. They define "creative activity" as "that form of activity which results in the actualization or realization of some object or event, which only comes into being because the creator having first conceived it in his imagination deliberately transforms his idea or vision into fact." On the Rorschach Test the results are not presented in detail, but it is stated that the leucotomized group show less originality and creativity than normal people of the same age, social status and educational background. Answers tend to be conventional responses evoked by large, obvious details. Where there was a pre-operative record, many post-operative records are mere repetitions rather more accurately described and with the more bizarre details omitted. Human and human movement responses are introduced post-operatively, but they are relatively infrequent, and the majority of new answers are provoked by colour, or in some cases by texture, and are mainly conventional animals or objects. The introduction of new shading responses is relatively uncommon. These authors also used the multiple choice Rorschach of Harrower-Erickson, upon which they compared a group of leucotomized patients with a group of adolescents. There is no statistical evaluation of the results, but certain conclusions are suggested. The leucotomized group shows a small number of human responses, but the outstanding feature is the high proportion of completely formless answers in uncoloured cards, including those indicative of unpleasant feeling—tone in looking at the card (nightmare, etc.); and in card Nine an evasion of the responses or mere statement of the colours of the blots. Also outstanding was the high proportion of failure indicating inability or refusal to formulate anything. The investigators feel that these findings, coupled with the clinical observations of the lack of initiative in some of the patients and a tendency to live in the

immediate present and to depend on the immediate environment for stimulation, suggest that there might be a definite diminution of creative activity after leucotomy. As a test of imagination the subjects were asked to write a story introducing certain sentences. Though there is little data as to how normals do the task, it is suggested tentatively that leucotomized patients find this test more difficult than normals. The patient's stories tend to be brief, and are either auto-biographical or an account of something read or heard. A further qualitative test consisted in getting the patients to draw or paint either to order or as they liked. Paintings of the leucotomized group were ranked low for creative ability, though this deduction is very tentative because of an insufficient number of paintings. This investigation was handicapped, because few patients show evidence of a creative urge prior to leucotomy, and therefore it was impossible to tell whether the absence of creative imagination after the operation was the result of the operation. This acknowledgment by the authors seems to underline the main weakness of the investigation, which is their failure, in most cases, to examine patients before and after operation.

In actual fact, in a later study Ashby and Bassett (1) developed a more specialized test to measure creative ability. The test depends, essentially, on the patient's ability to add to a painting imaginative details which were neither present in the example, nor suggested by the examiner. The performance of a group of leucotomized subjects on the test was compared with that of groups of psychotic and normal subjects. The results showed no evidence that creative ability is impaired by prefrontal leucotomy. It is still necessary however, to support this conclusion by testing the same subjects before and after leucotomy.

Babcock (2) tested one case of anxiety neurosis with the Babcock tests, before and three months after leucotomy. These include verbal tests (vocabulary, opposites, sentence completion, analogies, etc.) and tests of "basic efficiency" (perception, speed, learning, motor control, etc.). The results indicate greater mental impairment in both the understanding and efficiency variables of functioning. The subjects total rating of mental efficiency was over one year lower than pre-operatively, and more than five years below the norms for his verbal level. Koskoff *et al.* (53) administered the Babcock-Levy examination to five cases and report an overall loss in the functions measured by the efficiency battery. This suggests a general post-operative deterioration.

The most striking of Rylander's (84) results was on a word enumeration test (the subject gives as many nouns as possible in three minutes with his eyes closed) given to three subjects. There was a definite and considerable reduction at the first retest 2-4 months post-operatively. Later there were gains, but performance did not reach the pre-operative level. Yacorzynski *et al.* (98) administered a considerable number of special tests to a single subject pre- and post-operatively, tests with ambiguous figures, illusions and reversal of perspective; level of aspiration; level of motivation on the Thematic Apperception Test: results on these tests were unchanged post-operatively. The number of responses on the Rorschach decreased post-operatively from 71-14; popular responses decreased from 4-2; tendencies to confabulation and contamination were exaggerated. The effect of leucotomy appeared, therefore,

to be a release of the psychosis. Scores on the Minnesota Multiphasic Personality Inventory, however, show a return to normality following leucotomy. There were many high scores pre-operatively, but no wide divergencies in profile post-operatively, and these are well within the limits of the average population. Certain grouping tests were given involving, for example, the separation of blocks into groups on the basis of common categories. Such tests are considered to involve reasoning and concept formation. The Vigotsky Test and Kohs Blocks were also used. There were marked changes on tests of this type. The results indicate that after leucotomy reasoning and concept formation are markedly affected when the subject has to deal with factors removed from his immediate environment, i.e. abstract concepts. He is capable of handling his immediate environment as well as pre-operatively.

Malmo (59) attempted to measure changes in certain special psychological functions after leucotomy and gyrectomy. There were 8 leucotomy cases, though not all were tested with each test, and sometimes one or more gyrectomy cases is included in the group. The ability to learn nonsense syllables in series by the rote method appeared to suffer after operation. The patients took longer to learn following the operation in spite of pre-operative practice. There was no loss on the Wechsler Memory Scale, but there were reductions in score on the Hunt Minnesota Test. Other tests of immediate memory (e.g. digit and sentence span, picture recognition, Halstead memory for objects) yielded negative results. Tests of abstract thinking were administered. There were changes in the direction of greater concreteness of definition post-operatively on Vocabulary Tests. Small groups showed a loss in categorical attitude on the Halstead Sorting Test, and a loss of abstract thinking in Kohs Blocks. Deliberation was tested by the time taken to do the Matrices. This test was done more quickly post-operatively. This result is in line with Robinson's (81) suggestion that deliberation is reduced after leucotomy. Malmo's results on the "slow writing" and "disguised writing" tests, which Robinson used to demonstrate decreases in deliberation, did not confirm her findings. Malmo reports results from only three patients on these tests, however, and so the disagreement cannot be considered crucial. On a pain stress test there was a greater incidence of withdrawals in the frontal lobe group than in a group of unoperated subjects, and, in the frontal lobe group, a greater incidence of withdrawals post-operatively than pre-operatively. Every case tested pre- and post-operatively showed some increase in galvanic skin response upon stimulation. This shows increased responsiveness to external stimulation. On the mirror drawing test, it has been suggested by Wechsler and Hartogs (95) that impairment of manual control is shown by an increase in the distance of the line drawn from one point to another. A poor performance is characteristic of the anxious neurotic. Malmo's experimental group showed a statistically significant reduction in manual disturbance after operation. It is pointed out that this is not the effect of practice, because neurotics who have had no treatment actually perform worse on retest, and, with normals, the practice effect is slight. These results are considered objective evidence of a reduction in anxiety following leucotomy. The experimental results as a whole, including those from the intelligence tests, discussed earlier, is considered

"strong evidence for the conclusion that frontal lobe operations lead to a definite loss of general intelligence." Furtado *et al.* (30) gave the Rorschach Test pre- and post-operatively to a group of six subjects whose pre-morbid personality was well known. A decrease in the number of W responses is considered as reflecting an alteration in abstract thought. There was a corresponding gain in D and Dds responses. An increased number of weak original responses following a growing number of F-forms it is considered emphasizes the intellectual weakening.

The major part of an investigation by Petrie (71) on a neurotic group consists in an attempt to verify the hypotheses that personality changes following prefrontal leucotomy are in the direction of a decrease in intelligence, a decrease in neuroticism, and a movement away from extreme introversion. These hypotheses are based on the work of Eysenck (13), who, in a factorial analysis of the inter-correlations between 39 trait ratings carried out by psychiatrists on 700 neurotic patients, extracted two main factors. The first factor was a general factor of "neuroticism." The item which was most characteristic of this factor was "badly organized personality." The second factor was bipolar, and opposed the affective or dysthymic group of symptoms (anxiety, depression, obsessional tendencies, etc.) to the hysterical group of symptoms (conversion symptoms, sex anomalies, etc.). Later, on the basis of experimental studies, Eysenck decided that the hysteria-dysthymia factor was identical with Jung's conception of extraversion-introversion. Petrie used tests previously validated by Eysenck in order to investigate the hypothesized decreases in neuroticism and introversion following leucotomy.

The hypotheses are supported by the experimental results. The decrease in intelligence has been described. A decrease in neuroticism is suggested by a significant decrease in body-sway suggestibility. This finding is supported by a significant increase in the smoothness of the curves of activity of two tasks. First, rate of tapping in 4 quarter-minute periods: before operation the mean deviation from the average is significantly greater than after operation. Second, on the track tracer, relapses, i.e. losses in speed in consecutive trials, were greater prior to operation than post-operatively. These results are relevant, because of the finding that the work curve of neurotics is more jagged and uneven than that of normals. Further, on the arithmetic, picture completion and picture arrangement sub-tests of the Wechsler there is a decrease in the number of mistaken answers in relation to the number of correct answers; on the perseveration test involving alternating work, there are reduced P-scores following leucotomy. These changes all support the hypothesis of decreased neuroticism after leucotomy.

The increase in extraversion is suggested by significant changes on the scores of several tests. There is a loss in persistence. On the Track Tracer the time taken is decreased and the number of mistakes increased: post-operatively the group tends to go for speed rather than accuracy. On the level of aspiration test the discrepancy between goal and performance is less, and the gap between performance and judgment is decreased: after leucotomy aspiration and judgment are more in line with reality.

Certain other changes, not directly relevant to the main hypotheses, are

reported by Petrie. The patients show a decrease in the number of traits for which they blame themselves, and, further, a decrease in the intensity of self-blame. Their attitude to the present and the future was judged by answers to eight standardized questions: the subjects tended to leave the past behind, to live largely in the present and to look hopefully to the future. Pre-operatively they tended to be orientated towards the past. Petrie points out that, as a result of these changes in the cognitive, conative and affective facets of personality, leucotomy causes some considerable alteration in personal effectiveness.

There are features to this investigation which make it of importance. First, the group consists of patients diagnosed as neurotic rather than psychotic. Thus the quality of the psychiatric material is unusually high for this type of investigation. Second, this is one of the few investigations in which a definite quantitative hypothesis is investigated which can be verified or disproved. Third, the group is moderately large for work of this type. Fourth, one surgeon operated throughout and used a standard operative technique (57).

The picture of the post-leucotomy personality supports the hypotheses more clearly at the nine-month retest (72). Although nearly all the changes in neuroticism, introversion and intelligence had appeared after three months, there are exceptions. Some changes are clearly shown only after nine months; some tendencies are accentuated and some are damped down. Persistence continues to decrease during the year, speed and number of mistakes to increase. Planning as measured by the Porteus Mazes appears to improve after the early loss. There is no significant loss in score on this test after nine months. Increased distractibility manifests itself clearly only after a longer period, and reverses the earlier impression.

An investigation also largely based on the work of Eysenck was conducted by the present author (9). Thirty-six psychotic patients were tested before, and three months after, prefrontal leucotomy on a test battery which included cognitive tests, objective personality tests and the Rorschach Test. The post-operative changes on tests of speed-accuracy, persistence, level of aspiration and on the Rorschach "Experience Type" gave no consistent support to the hypothesis that a psychotic group becomes more extraverted following leucotomy. There was little change after leucotomy in the scores on tests of "neuroticism," although the general direction of the changes on the tests of suggestibility, static ataxia and reversal of perspective suggest a decrease in the "neuroticism" of the group. Post-operative changes in scores on the cognitive tests are also small. Of the tests used, the Mill Hill Vocabulary Test and the Porteus Maze Test were the most sensitive to changes in intelligence following prefrontal leucotomy. The results gave no real support to the hypothesis of a decrease, after leucotomy, in the intelligence, neuroticism and introversion of the group. The differences between these results and those of Petrie (71, 72) are probably due to differences in the type of group tested: Petrie's group was entirely neurotic; the present group was almost entirely psychotic.

The research was extended to investigate certain problems suggested in the psychiatric literature which had not been studied using objective methods. An attempt was made to assess the relation of changes in test scores after

leucotomy to the following factors : psychiatric diagnosis, pre-operative length of illness, the different techniques and intentions of the surgeons, and the post-operative clinical status achieved by the patients. Psychiatric diagnosis was significantly related to the changes on the " affective discrepancy score " derived from the level of aspiration test. The paranoid and affective groups tended to become more realistic in their aspirations and judgments after leucotomy, the schizophrenic group to become less realistic. This may confirm the general finding that a smaller percentage of schizophrenics tend to be clinically improved by leucotomy.

Length of illness may be related to the changes in the scores on one test, the test of static ataxia, but the evidence from the present group (mean length of illness just over four years) does not demonstrate this convincingly.

More posterior surgical lesions tend to cause a deterioration in scores on the Porteus Maze Test. This may be due to the effect of the operation on certain non-intellectual personality factors such as planning and foresight, measured by this test.

Post-operative clinical status was related significantly to changes in scores on the R-V Manual Dexterity Test. Patients who were clinically improved to any extent performed better on this test after leucotomy ; patients who are unimproved performed worse. These results may reflect the increased normality of the improved patients ; they may also be related to the pre-operative presence of, and post-operative relief from, mental tension in the clinically improved patients. Changes in scores on the Rorschach Test were found not to be related to post-operative clinical improvement at a statistically significant level.

An attempt was made to predict, from the pre-operative test scores, the most probable degree of recovery for each patient. This was done by calculating the multiple regression of the recovery rating on the pre-operative test scores. The R-V Manual Dexterity Test and the total number of responses on the Rorschach Test, used together, gave a multiple correlation of 0.646 with the criterion. By the use of an " improvement score," derived by suitably weighting the pre-operative scores on these two tests, it was found possible to predict, with about a 30 per cent. error of misclassification, whether patients in the present group would be clinically " improved " or " unimproved " after leucotomy.

Jones (44) analysed Rorschach records for 27 variables which revealed no great post-operative changes. This fact suggests that the personality structure is not basically disturbed. There are, however, several statistically significant changes : mean total responses increased, mean card rejections decreased and reaction time decreased. The first ten cards of the T.A.T. were presented as a basis for the patients to build stories. Very few of the patients really made up a story. Post-operatively, there were certain statistically significant changes ; a smaller percentage of pictures were rejected, and there were increases in the number of descriptive responses and in interpretations. The Bender Visual Motor Gestalt Test records were analysed for 19 variables. There was a significant decline in rejections and a decrease in schizophrenic elaborations. The arrangement of figures was categorized as confused, horizontal or vertical.

There were significant changes in the direction of fewer confused arrangements. Size reproductions were classified as the same, diminished or expanded. The early post-operative testing revealed a statistically significant tendency to reduction of figure size. Further post-operative changes were in the direction of fewer reductions and slightly more expansions, with the percentage of "same" size reproductions remaining somewhat below the pre-leucotomy level. There was a statistically significant improvement six months post-operatively on several short tests: naming pictured objects, reading names of objects, interpreting a pictured social situation, detecting picture absurdities and solving simple arithmetic problems. Sixteen patients were given the Goldstein-Scheerer Colour Form Test. Three successfully sorted according to both colour and form pre-operatively. Three months after operation six accomplished successful shifts. Emphasis on colour sortings tended to increase during successive re-testings. Prior to leucotomy there were six colour and four form sortings for the group; at the third retest six months post-operatively there were seventeen colour as compared with six form sortings. This suggests a greater tendency to outer rather than inner control.

(c) *Summary.*

The main conclusions to be drawn from the results of *cognitive testing* before and after prefrontal leucotomy are as follows:

1. Results from the Stanford-Binet and the Wechsler-Bellevue tests show that scores on the *Binet* consistently tend to decrease slightly after leucotomy. These changes are, however, statistically insignificant (89, 74, 84, 98). A decline in score on the full Wechsler scale is reported, this decline being statistically significant in the investigations of Koskoff *et al.* (53) and Malmo (59). Further, it is emphasized that the losses are greater on the verbal than on the performance scale (53, 98, 44, 71).

2. These indications tend, on the whole, to be confirmed by the results from other verbal tests. In the investigation by Ström-Olsen *et al.* (89) scores on the Terman and Shipley Vocabulary Tests both decrease, although the changes are statistically insignificant; in the investigation of Malmo (59) scores on the Stanford-Binet Vocabulary Test show statistically reliable losses for a group consisting of six lobotomy and two gyrectomy patients. Robinson *et al.* (82) report that on the Stanford-Binet Vocabulary Test, the scores of 68 leucotomized subjects were slightly, but not significantly, worse than the scores of 12 non-leucotomized subjects matched for age and diagnosis. Of the cognitive tests used by Crown (9), the Mill Hill Vocabulary Test was the most sensitive to changes in intelligence following prefrontal leucotomy.

3. The main performance test for which results are available is the *Porteus Mazes*. Results from the more important investigations are not entirely consistent. Ström-Olsen *et al.* (89) and Jones (44) report slight, but statistically insignificant rises in score after leucotomy. Porteus and Kepner (74) and Porteus and Peters (75) report statistically significant decreases after leucotomy. Crown (9) found a slight but statistically insignificant post-operative loss in score on this test. Petrie (71, 72) found a significant loss in score on the

Mazes three months after leucotomy, which was partly regained by the nine months' retest. However, as Porteus and Peters (75) have shown that non-leucotomized subjects show a marked practice effect on retesting with the maze, their conclusion that the maze test is sensitive to post-leucotomy changes in intelligence would appear justified.

4. Of other performance tests, scores on *Kohs Blocks* and *Alexander's Passalong Test* tend to show a slight, but insignificant, rise after leucotomy (38, 89). In one report (44) the *Goodenough Drawing-a-Man Test* shows a statistically significant increase.

5. Scores on a non-verbal, perceptual type test, *Raven's Progressive Matrices* in one study (89) show a slight, statistically insignificant rise.

6. These results support the view that there are certain intellectual changes following prefrontal leucotomy. Of those tests so far investigated scores on certain verbal intelligence tests and the Porteus Mazes Test show the greatest post-operative deficits.

Findings from the *special investigations* have not been confirmed to the same extent as those from the clinical studies and the studies using formal tests of intelligence. Certain findings appear, however, to have been reliably established. These are as follows:

1. Quantitative changes on the *Rorschach Test* are small (38, 51, 44). Further, there is little agreement between investigators as to the changes that take place.

2. A decrease in *neurotic tendency* is reported by Hunt (38) using the Bernreuter Personality Inventory and the Rorschach Test; and by Petrie (71), who reports a post-operative decrease in body-sway suggestibility, and an increase in the smoothness of certain work curves. On certain sub-tests of the Wechsler Test there was a decrease in the number of mistaken answers in relation to the number of correct answers. On a perseveration test there were reduced P-scores following leucotomy.

3. An increase in *extraversion* is reported by Hunt (38) and by Greenblatt *et al.* (33), shown on the Rorschach test by changes in the M : Sum C ratio. A similar change is suggested by Petrie (71) because of changes in the scores on certain objective personality tests: the group is less persistent post-operatively, goes for speed rather than accuracy and, on the level of aspiration test, brings aspiration and judgment more in line with reality.

4. Schrader and Robinson (85) and Jones (44) rated groups of chronic schizophrenics on *ward behaviour* charts. Improvement in total adjustment scores following leucotomy is reported in both investigations.

5. Impairment, after leucotomy, on the Babcock tests of "*basic efficiency*" (perception, speed, learning, motor control etc.) is reported by Babcock (2) and Koskoff *et al* (53).

6. There is little consistency between investigators as to whether or not *abstraction* is affected by prefrontal leucotomy. Kisker (49) and Jones (44) suggest there are no important changes, whereas Greenblatt *et al.* (33), Yacorzynski *et al* (98) and Malmo (59) consider that there is a loss on tests of abstract thinking. This lack of agreement is not surprising considering the variety of tests used by these and other investigators to test abstraction. Tests used

include: Kohs Blocks, the Goldstein-Scheerer Colour-form Sorting, Halstead's Grouping Behaviour Test, the Rorschach Test, the Vigotsky Test, Vocabulary Tests (49, 33, 98, 59, 44); the Shipley Hartford Test (14, 81); proverbs, fables and abstract words (84). These tests seem to be of two main types: First, tests which must be considered primarily as intelligence tests; these include Kohs Blocks, Vocabulary Tests, the Shipley-Hartford Test, proverbs, fables and abstract words. Second, tests which appear to conform to Halstead's (34) definition of abstraction as the basic capacity to group to a criterion which involves the comprehension of essential similarities and differences. This group includes tests such as the Goldstein-Scheerer Colour-form Sorting Test, Halstead's Grouping Behaviour Test, the Vigotsky Test and others. It is suggested from this analysis that, in factorial terms, sorting tests, if included in a test battery with other cognitive tests, would cluster together, these tests having, in addition, moderately high correlations with intelligence. Whether the abstraction group factor would be different from group factors already widely recognized remains a problem for further research.

III. GENERAL CONCLUSION.

It is clear from this review that certain psychological changes can be observed in patients following prefrontal leucotomy. From the psychiatric point of view the syndrome caused by prefrontal leucotomy has been described as being characterized by apathy, lack of spontaneity, fatuous equanimity, absence of finer emotional response, thoughtlessness and, at times, euphoria. In the selection of cases which will respond well to the operation, the presence in the symptomatology of signs of emotional response is considered generally to be the most important criterion. Further, the suggestions have been made that there are no changes in intellectual functions following leucotomy, and that the non-intellectual changes are too slight to be recorded using psychometric methods.

Recent objective studies do not support these latter observations. On the intellectual side, the scores on verbal intelligence tests and on the Porteus Mazes have been shown to decrease following leucotomy. Other studies have shown that there are measurable post-operative changes in certain non-intellectual functions. Robinson (81) and Robinson, Freeman and Watts (82) tested the hypothesis that there is a loss of capacity for prolonged attention after leucotomy. This hypothesis was confirmed using objective tests of "deliberation" and three of the Downey Will-Temperament Tests. Petrie (71, 72), using carefully defined, quantitative hypotheses susceptible of clear confirmation or rejection, showed that, in a neurotic population, changes take place along at least two dimensions of personality: after leucotomy neurotic patients show a decrease in general "neuroticism" and an increase in extraversion.

It is with clearly formulated hypotheses that future psychometric studies of the changes following leucotomy should be concerned. Further, these investigations should be extended in several directions: the cognitive testing by the inclusion of tests of all the widely recognised group factors;

the non-intellectual personality testing by continued attempts to devise tests to measure the more subtle, yet clinically observable, post-operative changes. Attempts should also be made to test large enough samples to allow of sub-grouping according to important variables such as diagnosis, type of operation, etc., so as to have equal or proportionate numbers in each sub-group. In this way a factorial design may be possible in which an estimate can be made not only of the relationship of all the variables to the changes in test scores after leucotomy, but also of the effect of the interaction between these variables.

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THE USEFULNESS OF THE RORSCHACH TEST FOR DIAGNOSIS, PROGNOSIS AND EPICRISIS, MAINLY IN CHILD GUIDANCE TREATMENT.

(Based on a paper read to the International Congress of Psychology, July, 1948, in Edinburgh.)

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AIM AND PLAN OF THE INVESTIGATION.

THIS paper is based on 66 child guidance cases. Children under 7 years were excluded because my Rorschach experience with them is too slight. All had psychotherapeutic treatment, mainly analytical, some had purely permissive play therapy, some combined this with analytical treatment. A few were treated indirectly through therapy of the parents. I have included some adults, parents of clinic cases, and one teacher.

Diagnosis and prognosis were never made on less than three diagnostic interviews, including testing interviews. Estimates of the treatment results were conservatively restrained.

Child guidance diagnoses are necessarily complex and cannot advantageously be reported in summary form. I have indicated, therefore, for superficial orientation, the main symptoms. The classification of symptoms aims at being both descriptive of appearances and also, to some extent, explanatory as to the nature of the disturbance. I am aware of the multiple basis of many of them. So, for instance, some truancy would more properly come under category B than C (in the tables), or insomnia may be D, E or C. The classification is pragmatic-clinical. Anxiety is involved in most and not separately indicated, unless a very prominent symptom. The overlap of the categories is great, but for the purpose of this paper this is of relatively minor significance, especially to adherents of the view that psychotherapy generally ought to aim at enlarging consciousness, and that it is almost irrelevant which corners of the veil are lifted ; as the main purpose is to establish a more wholesome balance between consciousness and unconsciousness.

Prognoses were, of course, not based on Rorschach records only, as far as the clinic was concerned ; but the prognoses as indicated in the table were made purely on the basis of the Rorschach test. The usefulness of the Rorschach test in conjunction with other diagnostic procedures is much greater than is apparent from the table. But the aim here is to gauge the value of this test as an isolated instrument. As to the reliability of Rorschach test results as gauged by clinical assessment, this topic is discussed elsewhere (1).

Furthermore, the value of other signs than Rorschach test result, e.g. intelligence, nature of disorder, length of treatment, etc., is not investigated here ; although some of those signs are indicated in the table. But although the sample of cases is, if small, considered to be a fair one, it has not been

thought appropriate in this clinical paper, based on this relatively small number of cases, to enter statistical analysis of these signs further than has been done.

RORSCHACH SIGNS AND PSYCHOPATHOLOGY.

The great variety of psychopathological bases underlying the same phenomena of disorder, not to mention the great variety of these phenomena themselves, and all possible combinations, makes their discussion here impossible. It is just as impossible to discuss the possible patterns of the Rorschach records that formed the basis for this investigation, unless we use a more manageable method like the numerical assessment of Rorschach test results, as described in (1). I have, therefore, been driven to present some generalizations which were in my mind when assessing the test records.

Whilst, broadly speaking, a severe disorder is more difficult to treat and may occupy a longer time till success is attained, severity and treatability, and, therefore, prognosis, do not necessarily correspond point by point.

The Rorschach record does not mirror primarily content but mainly the dynamics of the disorder and its underlying personality, and so may hint very effectively at the approachability and treatability of the patient.

Constricted persons (high F percentage) are always difficult to approach. Rejections of cards may reflect anxiety, based on anything from defiance to schizophrenia. High stereotypy (e.g. high A percentage), coupled with high F percentage makes the picture almost hopeless, if quick results are required, as is almost the rule in child guidance. Discrepancies between r/R (r being the number of responses to the last three cards, R that to all cards), $M : \text{Sum } C$ and $FM + m/Fc + c + C'$ denote tensions, but these tensions are not necessarily of a negative nature and discouraging meaning, as far as therapy is concerned. Colour or dark shocks also have their positive significance, unless so crippling that rejections result or unless they assume psychotic strength. $W : M$ points to the degree of success of attempted compensation for the disability. F per cent. far above 50 per cent., many C responses, coarctation, or, at least, absence of all colour responses are definitely of bad omen, unless strongly compensated for by other signs. Whilst the presence of FK and Fc indicates the presence of suffering and insight in many records, when occurring in greater number, hardly any of my delinquent patients showed this sign.

The following signs, appraised in isolation, appeared among the most significant ones ; R ; Rejections ; F per cent. ; $F+$ per cent. ; $FK+F+Fc$; C ; Sum C ; S ; M ; W per cent. ; A per cent. ; $M : \text{Sum } C$; r/R ; $FM+m/Fc+c+C'$, approach, succession, shock, intellectual level and efficiency.

A few more words on some points of psychopathology and their bearing on the Rorschach picture may be apposite here.

As to intellectual difficulties : in the case of low intelligence pure and proper, there is, of course, no hope of influencing the condition psychotherapeutically. The condition would be diagnosed by intelligence tests mainly and the usual signs of low intelligence in the Rorschach test.

The presence of signs of low intellectual efficiency, as they appear in the Rorschach record, and other disturbing factors affecting the personality picture, like neurotic and autistic signs, may indicate that an attempt at psycho-

therapy is possibly advisable, and the prognosis will be made accordingly. This approach appears clearly in the tables. In the case of discrepancy between intelligence test results and Rorschach results I have the authority of Loosli-Usteri (2) to place more reliance on the Rorschach test.

There is little to be said about neurotic, prepsychotic and organic disorders the special signs for which are well-known or else undefined. In the case of organic disorder, diagnosis and prognosis will be more difficult on the basis of the Rorschach test alone and will be based mainly on clinical-medical evaluation. The signs for these disorders will, however, often be present, unless the picture is overshadowed by general deterioration.

Behaviour difficulties and habit disorders overlap to a great extent as to their psychological bases. Enuresis, obstinacy and tantrums may all show signs of rebellion, e.g. S. They may show signs of inferiority feelings (many FK), anxiety (K), often toned down and rationalized in the case of enuresis (k); and often the signs of "super-ego deficiency" may be apparent, although the symptoms that result from the disorder may not fall into that category, but rather serve as defence mechanisms to prevent that deficiency from emerging.

I have been specially interested in "super-ego deficiency." My experience has been rather different from that usually accepted. Although the purpose of this paper is less that of a differential-diagnostic and prognostic elucidation of psychological disorder than that of the general usefulness of the Rorschach test for diagnosis and prognosis, I should like to intersperse a few words on this problem, in the hope that some day I shall be able to present fuller details. Friedlander (3) refers to the socio-psychological phenomenon of super-ego development, with special reference to juvenile delinquency. While I disagree with the theoretical concept of the super-ego and its psycho-analytical description as essentially the introjected father, but see in it a projection, and later, re-introjection of the archetype of the self (4), her view is on the whole acceptable as a working hypothesis. I experienced two principal types of delinquent: the autistic-explosive and the constricted. Both types are usually coarctated or coerced. The constricted was much more frequent, and prognosis is bad in the absence of anxiety and c. This does not necessarily hold for the compulsive delinquent, of whom I have had little experience.

SUMMARY OF RESULTS.

Sixty-three per cent. of the cases showed a high correspondence between Rorschach prognosis and treatment result. In 32 per cent. of the cases the correspondence was less close, and in 5 per cent. of the cases prognosis and result were unconnected. Taking into account circumstances of diagnostic importance other than the test, the prognosis closely corresponded to the treatment result in approximately 90 per cent. of the cases, with accompanying diminution of the less-close-correspondence group, still leaving wrongly prognosticated cases at roughly the same numerical level. Thirteen cases were retested after the termination of treatment; in 12 the Rorschach record had become much more normal; in 1 it had become worse, as was expected from the trend the disorder had taken.

SUMMARY.

An unselected group of 66 child guidance patients was tested by the means of the Rorschach test. Thirteen patients were retested. A diagnostic and prognostic view was formed on the basis of the Rorschach record, and the prognosis was compared with the clinical results of psychotherapeutic treatment. Correspondence of prognosis and treatment results was close in 63 per cent. of the cases, less close in 32 per cent., absent in 5 per cent. In conjunction with other diagnostic procedures a much higher reliability was attained. Where retests were performed, the result of treatment corresponded closely with the final Rorschach picture in all but one out of 13 cases.

Furthermore, some points of psychopathology and their bearing on the Rorschach record have been discussed.

In my clinical work in child guidance I have found the Rorschach test the most revealing, reliable, least time-consuming, single diagnostic tool.

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EXPLANATORY NOTE TO TABLE.

I.Q.—INTELLIGENCE QUOTIENT ACCORDING TO THE REVISED
STANFORD-BINET INTELLIGENCE SCALE.

Main symptoms :

- A. Intellectual Difficulties : Low intelligence and other causes that interfere with achievements at school and other intellectual pursuits.
- B. Super-ego Deficiency : Delinquency and disorders, like lying, that are based on the failure of the super-ego to develop adequately.
- C. Behaviour Difficulties : Obstinacy, aggressiveness, tantrums, some truancy cases, etc., that are due mainly to developmental fixations or reactions to milieu.
- D. Habit Disorders : Enuresis, stammer, etc., i.e. symptoms that are supposedly based mainly on faulty habit formation.
- E. Neurosis : The classic forms of neurosis.
- F. Pre-psychosis : Disorders suggesting the possibility of a later psychotic breakdown.
- G. Organic : Epileptic, choreic, encephalitic, endocrine, etc., disorders, mainly of the nervous system.

Length of treatment :

- S. Short, i.e. 1-12 therapeutic sessions.
- P. Prolonged, i.e. 13-24 therapeutic sessions.
- L. Long, i.e. 25- therapeutic sessions.

Results of treatment :

- 1, unchanged ; 2, somewhat improved ; 3, improved ; 4, very much improved ; 5, cured.

Prognosis derived from Rorschach record :

- + Curable or very much improvable, as results 4 and 5.
- * Improvable, as result 3.
- Somewhat improvable or unchangeable, as results 1 and 2.

Correspondence of treatment results and Rorschach prognosis :

+ Close correspondence, i.e. if prognosis and result respectively are—

— and 1 or 2 ;

or * and 3 ;

or + and 4 or 5.

* Less close correspondence, i.e. if prognosis and result respectively are—

* and 1 or 2 ; or

+ or — and 3 ; or

* and 4 or 5.

— No correspondence, i.e. if prognosis and result respectively are—

+ and 1 or 2 : or

— and 4 or 5.

Result of retesting :

+ The Rorschach record has become more normal.

— The Rorschach record has not become more normal.

1st column, case number ; 2nd column, age ; 3rd column, I.Q. ; 4th column, main symptoms ; 5th column, length of treatment ; 6th column, result of treatment ; 7th column, prognosis from Rorschach record ; 8th column, correspondence of prognosis and result ; 9th column, result of retest, where performed.

TABLE.

1	2	3	4	5	6	7	8	9
1	10	93	A	P	3	+	*	
2	9	84	ED	L	3	*	+	
3	10	97	C	P	1	—	+	
4	18	Super	D	L	3	*	+	
5	12	131	A	L	4	+	+	
6	13	110	B	S	2	*	*	
7	13	116	B	L	3	—	*	
8	10	81	BA	P	2	—	+	
9	13	129	C	S	5	+	+	+
10	9	128	C (F?)	L	5	+	+	
11	10	78	B	S	4	+	+	
12	13	99	A	L	4	*	*	
13	9	95	EG	S	3	+	*	
14	11	82	EC	L	3	—	*	+
15	15	100	D	P	1	—	+	
16	11	79	B	S	1	*	*	
17	11	92	BC	S	2	—	+	
18	13	94	CB	S	2	—	+	
19	13	Dull	B	P	1	—	+	
20	9	92	E	S	3	—	*	
21	13	93	B	S	5	+	+	
22	13	104	C (F?)	S	1	—	+	
23	8	100	AE	S	5	+	+	
24	13	101	B (F?)	S	2	*	*	
25	10	104	D	L	5	+	+	
26	14	114	BC	P	5	+	+	
27	10	81	AE	L	4	+	+	+
28	11	109	B	L	5	+	+	+
29	13	85	D	S	3	+	*	

TABLE—*cont.*

1	2	3	4	5	6	7	8	9
30	9	116	E	S	2	*	*	
31	14	92	C	P	4	+	+	
32	9	91	BE	L	4	—	—	
33	14	79	B	L	5	+	+	
34	9	177	E	L	5	+	+	
35	11	60	G	S	1	—	+	—
36	11	84	CE	S	5	+	+	
37	14	81	F	S	1	—	+	
38	14	95	EB	L	5	—	—	+
39	9	81	B	P	1	*	*	
40	15	123	D	L	3	*	+	
41	9	108	A	S	5	*	*	
42	13	115	E	P	5	*	*	+
43	Adult	Good	E	L	3	*	+	
44	13	120	DC	P	4	+	+	
45	13	61	D	P	3	—	*	
46	12	79	AC	S	3	*	+	
47	8	86	AD	S	4	+	+	+
48	13	94	B	S	1	—	+	
49	12	115	E	L	4	*	*	
50	7	83	A	S	2	—	+	
51	13	122	D	L	3	*	+	+
52	9	93	C (F?)	L	5	+	+	+
53	12	126	BG	S	3	—	*	
54	13	112	B	S	5	*	*	
55	Adult	Super	E	L	5	+	+	+
56	10	140	DB	S	3	*	+	
57	14	139	E	P	4	+	+	+
58	11	124	E	S	5	—	—	
59	11	83	B	L	1	—	+	
60	11	72	C	P	4	*	*	+
61	9	103	A	S	4	*	*	
62	8	106	EA	S	4	+	+	
63	12	108	BC	S	1	*	*	
64	8	103	EC	S	1	—	+	
65	14	123	E (F?)	S	1	—	+	
66	15	132	BG	L	5	+	+	

Mr. B. Leuliette, M.A., B.A., undertook some statistical calculations with the tabulated results, and reports as follows:

The scores were grouped on a three-point scale: I.Q.'s into (a) below 85, (b) 86–114, (c) 115 and above; actual results of treatment into (a) 1, 2, (b) 3, (c) 4, 5. The Rorschach prognosis has already been evaluated on such a scale.

Correlations between certain variates were worked out by the product-moment method. The correlation of I.Q. with result of treatment is significant, but it is not relevant to the subject matter of the paper; that of the Rorschach prognosis with result of treatment is + 0.71 and is statistically significant. This is, of course, rather a high value. Variates such as age, main symptoms, and length of treatment are unsuited to statistical evaluation.

EXPERIMENTAL STUDIES OF A PERCEPTUAL ANOMALY.

I. INITIAL EXPERIMENTS.

By M. B. SHAPIRO, M.A.,

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A. THE INITIAL OBSERVATION AND THE INITIAL HYPOTHESES.

1. The Observation.
2. Explanatory Hypotheses.

B. TESTING THE HYPOTHESES.

1. Experiment 1a.

- (i) Purpose.
- (ii) Subject.
- (iii) Materials.
- (iv) Procedure.
- (v) Results.

2. Experiment 1b.

Description and Results.

C. THE NEW HYPOTHESES.

D. TESTING ONE OF THE NEW HYPOTHESES.

1. Experiment 2a.

- (i) Purpose, Subject, Materials and Procedure.
- (ii) Results.

2. Experiment 2b.

- (i) The Materials.
- (ii) Results.

E. DISCUSSION.

1. The Findings and Other Facts in Perception.
2. Methodological Implications of Experiments on the Single Case.

F. CONCLUSIONS.

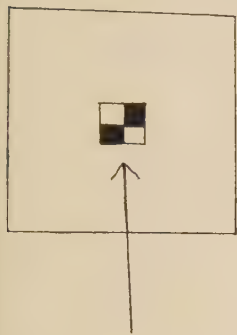
A. THE INITIAL OBSERVATION AND THE INITIAL HYPOTHESES.

1. THE OBSERVATION.

It was noticed that, during the performance of the Kohs Blocks Test, a few patients would in some cases make the model correctly, but misoriented. Illustration 1 gives an example of such a phenomenon. The patient had to reproduce the design shown with four Kohs Blocks. His reproduction is shown. The pattern has been correctly reproduced, but has been misoriented by 45°. The pattern was never in fact misoriented to a greater extent than this.

2. EXPLANATORY HYPOTHESES.

The first step deemed to be necessary was to search for an hypothesis or set of hypotheses which would provide a basis for predicting the frequency of the appearance of the anomaly. It was decided to take Goldstein and



Design to be reproduced.

Misoriented production with
4 Kohs Blocks.

ILLUSTRATION 1.

Scheerer's (4) general hypothesis that anomalies of perception are functions of figure ground relations.* Within this general hypothesis three, more precise, hypotheses have been developed about the material used in the Kohs Test. These three hypotheses provide a basis for predicting the relative frequency of appearance of the anomaly described above.

The first hypothesis is that the square orientation of a figure would tend to diminish the frequency of appearance of the anomaly, while the diamond orientation would increase it. (See Illustration 2, Cards a and d.)

The second hypothesis is concerned with the influence of the factor of congruence between figure and ground. Where figure and ground are of the same shape and similarly oriented they are said to be congruent. (See Illustration 2, cards a and c.) The hypothesis states that the congruent figure-ground arrangements of the material would tend to decrease the frequency of the appearance of an anomaly, while an incongruent arrangement would increase the frequency. Cards b and d in Illustration 2 would be said to be incongruent.

The third hypothesis is concerned with the relative influence of congruence and orientation of figure. Where the influence of congruence and figure orientation are in conflict the influence of the figure orientation is more potent.

These three hypotheses make it possible to build up a definite order of frequency of appearance of the anomaly. The patient ought to produce the anomaly least frequently for figure-ground combination "a" (Illustration 2), more frequently for combination "b," still more frequently for "c," and most frequently for combination "d."

This predicted order was in fact developed by Goldstein and Scheerer (4). The order was not expressed in terms of the relative frequency of appearance of anomalies, but in terms of time, i.e. Card "a" would presumably take the least time, Card "b" more time than "a," and so on. The experiments

* Throughout this paper the word "figure" applies to the design which the subject has to reproduce with the Kohs Blocks. The word "ground" applies to the card in which the design has been placed.

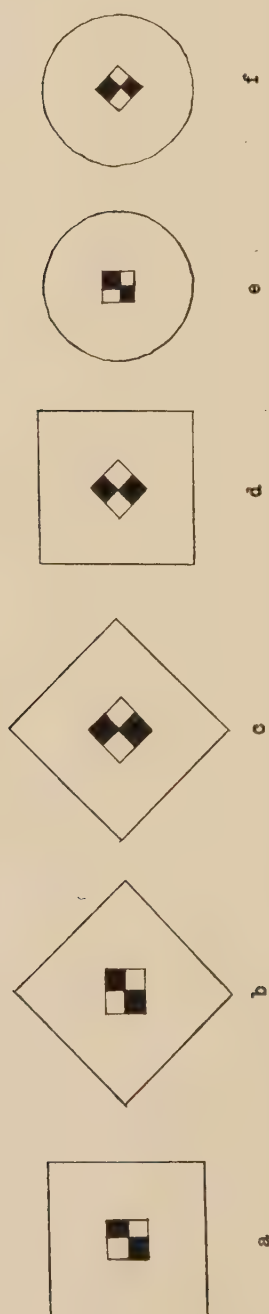


ILLUSTRATION 2.—The cards shown in this illustration will be indicated by the letters shown beneath them, both in the text and in the tables.

described in this paper, therefore, cannot be regarded as direct tests of the Goldstein-Scheerer hypotheses.

B. TESTING THE HYPOTHESES.

EXPERIMENT 1a.

(i) *Purpose*.—To test the three hypotheses stated above by seeing whether the actual order of frequency of appearance of the anomaly agreed with the predicted order.

(ii) *Subject*.—The subject chosen for the experiment was one of three who, in the course of psychological investigation at the Maudsley Hospital, had shown some impairment in the Block Design Test. The patient came to the hospital with a paralysis of the right arm and leg, which was diagnosed as hysterical. This condition gradually improved, but not completely, during the patient's stay. The patient was a woman of 32, her Wechsler test quotient was 90, with a performance score of 92, and a verbal score of 91.

(iii) *Materials*.—The figures chosen for this experiment were all sub-tests of the Goldstein Scheerer Block Design Tests. The particular figures chosen were those in which the patient had failed in one of the earlier stages of the subtest, but had later successfully completed according to the criteria laid down in the instructions for the Goldstein Scheerer Block Design Test.*

In this way designs which were obviously too easy or too difficult were ignored, and only those which were near the "limen" of failure were used. The figures selected in this way are shown in Illustration 3. Each figure was placed on white cardboard grounds of three different shapes, producing figure ground combinations of six types as shown in Illustration 2. The actual designs used are shown in Illustration 3 under the heading Experiment 1a. These three figures will be referred to in future as they are numbered in Illustration 3, i.e. Figs. 1, 2 and 3.

The reason for the square and diamond oriented grounds is obvious. They are essential for the examination of the Goldstein-Scheerer hypotheses. The circular ground was introduced to see what a circle would produce rather than a square or a diamond. Its introduction had no clear theoretical foundation. For purposes of this paper the results for the circular ground will not be analysed, though the results will be given.

The figures were 1 in. square. The square and diamond grounds were 6 in. square, and the circular ground was 6 in. in diameter.

* Each sub-test in the Goldstein-Scheerer Block Design is given in successive stages. First it is given with figure meaning, 1-in. square. If the patient fails at this stage the same figure is given again, but this time it is 2 in. square, and is in fact life size. If there is failure at this stage the figure is presented a third time on the same scale as the first, but lined so as to make clear the division of the design into four 1 in. squares. Failure here is followed by the presentation of the life-size figure, which this time is lined like the previous one. The fifth stage consists of the experimenter making an actual model with the four blocks for the subject to copy. Failure here is followed by the experimenter making up three models with the blocks, one of which is correct, and the subject is asked to point to the one that matches the design correctly.

If the subject succeeds at any one of these stages the first original one is immediately presented. If the patient succeeds this time the sub-test is completed. If he fails, the sub-test is continued at the next stage.

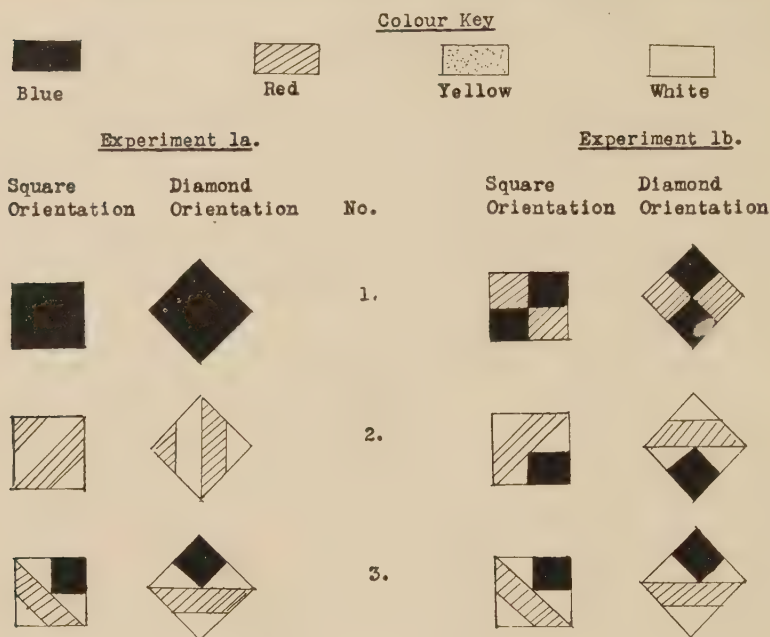


ILLUSTRATION 3.—Showing the designs of the figures used in Experiments 1a and 1b.

(iv) *Procedure*.—Six figure-ground combinations were presented to the subject. (See Illustration 2.)

The subject was given four Kohs blocks and told to make, with the blocks, a design like the one presented to her. Combinations a, b, c and d are those whose difficulties are predicted by the Goldstein-Scheerer hypotheses. From now on figure-ground combinations will be referred to as "cards."

When the subject had completed the figure with her blocks she was asked "Is that right?" If she assented, the watch was stopped, her actual production and time recorded. A trial was not regarded as completed until the subject assented to the question. A time limit of three minutes was fixed. This is the standard Goldstein-Scheerer procedure.

The patient's results were recorded in a manner calculated to provide no obvious cues. The experimenter always did the same amount of writing, regardless of whether the patient had reproduced the figure correctly or incorrectly, a standard notation being used.

At no time were the patient's errors discussed with her. Nor at that time were any other female patients being subjected to similar experiments, so that discussion in the wards was eliminated. On two occasions, when she was asked to state what her difficulties were, she pointed to some trivial blemish in the design, or to the fact that the blocks she used could not be made exactly level with each other. She never mentioned her actual error, the misorientation of the figure.

In deciding, for any one figure, the order of presentation of the cards, the effects of fatigue, perseveration and learning had to be considered. An attempt was made to equate the effect of these factors by the use of the Latin Square Design.

Such designs are provided by Fisher and Yates (3). In this particular experiment three figures were used. Each figure was presented on six different grounds, making a total of six different types of card. It was decided, therefore, to use a 6×6 Latin Square for each figure. For example, a random choice of one of Fisher's 6×6 tables results in the following scheme being chosen, in which the order and number of trials is indicated. (Each letter stands for a card as in Illustration 2) :

a	b	c	d	e	f
b	c	f	a	d	e
c	f	b	e	a	d
d	e	a	b	f	c
e	a	d	f	c	b
f	d	e	c	b	a

In this way the patient had, for the one design, 36 trials, and for any single card, 6 trials.

(v) *Results*.*—The results are shown and analysed in Tables I, II and III.

TABLE I.—*Showing the Number of Times the Misorientation Appeared for each Design. Experiment 1a.*

Card.	Figure No.			Total trials.		Total anomalies.
	1	3	3			
a	0	3	5	18	8	
b	5	6	5	18	16	
c	2	0	0	18	2	
d	0	1	0	18	1	
	—	—	—	—	—	
Totals	7	10	10	72	27	
	—	—	—	—	—	
e	0	3	4	18	7	
f	0	1	0	18	1	

For key to figures see Illustration 3.
 For key to cards see Illustration 2.

TABLE II.—*Order of Increasing Frequency of Appearance of the Anomaly for each Type of Card. Experiment 1a.*

Predicted order.	Actual order (in terms of increasing frequency).
a	d
b	c
c	a
d	b

For key to cards see Illustration 2.

* *Acknowledgment*.—The treatment of the data was designed and carried out by Mr. A. Lubin, of the Statistical Laboratory, Institute of Psychiatry. He has also given invaluable aid in the discussion of the methodological and psychological problems encountered in the course of the investigation described here.

TABLE III.—*Number of Misorientations. Experiment 1a.*

Figure orientation.	Ground shape		Totals.
	Diamond.	Square.	
Square .	16	8	24
Diamond .	2	1	3
	—	—	—
Totals .	18	9	27
<i>No. of misorientations :</i>			
Congruent total	= 10	Total trials	
Incongruent total	= 17	Trials per cell	

Table III can be expressed in terms of the percentages of trials in which the misorientation appeared. This is shown in Table IV.

(i) The actual order of frequency of appearance of the anomaly is almost completely opposite from that predicted, the rank correlation being $-.8$ (Table II). The reasons for this become clearer in paragraphs (ii), (iii) and (iv) below.

(ii) The influence of the figure was completely opposite to that predicted by the first hypothesis. This stated that the square oriented figure would produce fewer anomalies than the diamond oriented figure. Actually the square oriented figure produced significantly more anomalies at the 1 per cent. level than the diamond oriented figure (see Tables IV and V).

(iii) The influence of congruence was not exactly according to expectation. It appeared to play no part whatever in the production of the rank order illustrated in Table II above. However, it was strong enough for the congruent cards to produce 19.4 per cent. less anomalies than the incongruent cards, a difference which is significant at the 5 per cent. level only if the one tail test is used (see Tables IV and V).

(iv) The relative influence of congruence and figure where the two clashed was contrary to expectation. The square oriented figure in the diamond ground produced anomalies 89 per cent. of the trials, while the diamond oriented figure in the square ground (Card c) produced anomalies only 5.6 per cent. of the trials (see Table IV). No tests of significance were made. It will be remembered that the third hypothesis stated that where figure and congruence

TABLE IV.—*Experiment 1a. Misorientations as Percentage of Trials.*

Figure orientation.	Ground shape.		Totals.
	Diamond.	Square.	
Square .	88.9	44.4	66.7
Diamond .	11.1	5.6	8.3
Totals .	50.0	25.0	37.5

Congruent per cent. = 27.8 Trials per cell = 18
 Incongruent per cent. = 47.2

S.D. = .474. Where proportion of misorientations = p and $q = 1 - p$, the
 S.D. = $\sqrt{pq} = \sqrt{.375 (.625)}$.

37.5 is the best estimate of the proportion of misclassifications on the null hypothesis that there is no effect of figure, ground or congruence.

TABLE V.—*Experiment 1a.*

	Difference (in per cent. misorientation).	S.D. difference.	<i>t</i> ratio.	Level of significance.
Square minus diamond ground . . .	−25.0	11.4	−2.193	5%*
Square minus diamond oriented figure . .	58.4	11.4	5.123	1%*
Congruent, minus incon- gruent cards . . .	−19.4	11.4	−1.702	5%†

Formula for S.E. differences = S.D. $\sqrt{\frac{1}{N_x} + \frac{1}{N_y}} = \sqrt{\frac{2}{36}} = \sqrt{.055556} = .235703.$

Where S.D. = already found S.D. of misorientations in Table V.
 N_x = Total trials for 1 pair of cards compared.
 N_y = Total trials for the other pair of cards compared.
* Two-tail test. † One-tail test.

TABLE VI.—*Total Number of Misorientations for each Card of each Figure.*
Experiment 1b.

Card.	Figure No.			Total trials.	Total anomalies.
	4	5	6		
a . .	2	2	5	18	9
b . .	6	6	6	18	18
c . .	2	3	1	18	6
d . .	0	0	0	18	0
	—	—	—	—	—
Totals .	10	11	12	72	33
	—	—	—	—	—
e . .	2	4	3	18	9
f . .	0	0	2	18	2

For key to figures see Illustration 3.
For key to cards see Illustration 2.

TABLE VII.—*Experiment 1b. Observed Number of Misorientations.*

Figure orientation.	Ground Shape		Totals.
	Diamond.	Square.	
Square . .	18	9	27
Diamond . .	6	0	6
	—	—	—
Totals . .	24	9	33

Number of misorientations :
Congruent cards = 17. Trials per cell . . . = 18.
Incongruent cards = 18.

TABLE VIII.—*Experiment 1b. Misorientations as Percentage of Trials.*

Figure orientation.	Ground shape.		Totals.
	Diamond.	Square.	
Square	100.0	50.0	75.0
Diamond	33.3	0.0	16.7
Totals	66.7	25.0	45.8
Congruent per cent. = 41.7. Trials per cell . . . = 18.			
Incongruent per cent. = 50.0.			
S.D. = $\sqrt{pq} = \sqrt{.458(.542)} = \sqrt{.248236} = .498233.$			

TABLE IX.—*Experiment 1b.*

	Difference (in per cent. misorientation).	S.E. difference.	t ratio.	Level of significance.
Square minus diamond ground	-41.7	11.7	-3.564	<1%*
Square minus diamond oriented figure	58.3	11.7	4.983	<1%*
Congruent minus incongruent cards	-8.3	11.7	-0.709	Not significant†

$$\sqrt{\frac{1}{N_x} + \frac{1}{N_y}} = \sqrt{\frac{2}{36}} = \sqrt{.055556} = .235703$$

* Two-tail test.

† One-tail test.

were in conflict the influence of figure would always be greater than that of ground.

EXPERIMENT 1b.

Description and Results.

Because the results of Experiment 1a were so much the reverse of expectation, the experiment was repeated with three more figures, and with the same subject. The results were almost exactly the same as in the first experiment. The same order of frequency of appearance of the anomaly was found. As before, the square oriented figure produced significantly more anomalies than the diamond oriented figure, and the relative influence of figure and congruence were reversed significantly. The only change observed from Experiment 1a was that this time the influence of congruence was very small, the respective percentages of anomalies being 42 for the congruent cards and 50 for the incongruent. All the data are given in Tables VI, VII, VIII and IX and the designs used in Illustration 3.

C. THE NEW HYPOTHESES.

Four new hypotheses were developed to explain these results. The first hypothesis was that it was the orientation of the line of symmetry of a figure

which determined the relative frequency of appearance of the anomaly, and not the outline of the figure. The line of symmetry is the line which divides the pattern of the figure into two perfectly mirrored halves, as shown in Illustration 5. Where the line of symmetry is parallel with the vertical axis of the visual field, then the frequency of the appearance of the anomaly will be minimized. Where it is at an angle to the vertical axis of the visual field, then the frequency of the appearance of the anomaly will be maximized.

This symmetry hypothesis was deduced from an examination of the figures used in Experiments 1a and 1b. It was found that inadvertently all the figures used in these experiments, except one, possessed diagonal symmetry. The exception, Fig. 1, possessed both diagonal and rectangular symmetry.

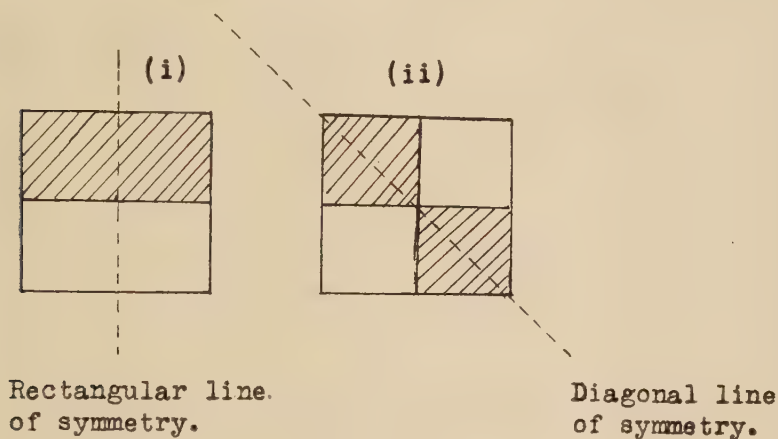


ILLUSTRATION 5.

Illustration 5 shows a figure of diagonal symmetry. Inspection of this figure shows that in the square orientation the line of symmetry is at 45 degrees to the vertical axis of the visual field, while in the diamond orientation the line of symmetry would be parallel to that axis. It will be remembered that, contrary to the Goldstein-Scheerer hypothesis, it was the square oriented figure which produced more anomalies than the diamond oriented figure. The symmetry hypothesis stated above was deduced from these facts.

The second hypothesis developed was that it was the shape of the ground which encouraged or discouraged the appearance of the anomaly. The diamond-shaped ground had increased the frequency of the appearance of the anomaly, while the square-shaped ground decreased this frequency. This hypothesis is an expression of the fact that in both experiments the square ground produced fewer anomalies than the diamond ground. The difference was significant at the 5 per cent. level in the first experiment (Table V), and at the 1 per cent. level in the second experiment (Table IX).

The additional influence of congruence could not, however, be ruled out, as it had produced a difference at the 5 per cent. level in the first experiment.

The third new hypothesis was that where figure and ground were in conflict the effects of the figure would be more potent than that of the ground. In

both experiments the figure produced more anomalies than the ground (Tables V and IX).

The fourth hypothesis was that the relative frequency of appearance of the anomaly was determined by an additive relation between figure and ground. This hypothesis makes it possible to recreate the order of frequency of appearance of the anomaly found in Experiments 1a and 1b. For illustration let us take the cards in Illustration 2.

It will be seen that the figure on the cards possesses diagonal symmetry. On the basis of the additive hypothesis the card producing the anomaly least frequently must be Card d because it possesses the two characteristics making for the non-appearance of the anomaly: vertical line of symmetry in the figure plus a square ground.

The card producing the greatest number of anomalies would be Card b. This is because it possesses the two characteristics making for the appearance of the anomaly—an angled line of symmetry in the figure and diamond ground.

Cards a and c each possess one characteristic making for the appearance of the anomaly and one making for its non-appearance. They will, therefore, produce fewer anomalies than Card b and more anomalies than Card d. Their relative order depends on hypothesis three, which states that when figure and ground are in conflict the influence of figure will be greater than that of ground. Therefore Card a produces more anomalies than Card c. The order of increasing frequency built in this way would then be: 1st, Card d; 2nd, Card c; 3rd, Card a; 4th, Card b.

If the symmetry hypothesis is correct then it should be possible to predict a new order of frequency of appearance of the anomaly for figures of rectangular symmetry. The effects of the orientation of the figure ought now to be reversed.

Where before a square oriented figure facilitated the appearance of the anomaly, it would now inhibit its appearance. Where before a diamond oriented figure inhibited the appearance of the anomaly, it would now be facilitated in its appearance. Assuming that the other three new theories would still hold, the following order of frequency of appearance of the anomaly would be predicted:

Card a	
b	(For equivalent cards see
d	Illustration 2.)
c	

D. TESTING ONE OF THE NEW HYPOTHESES.

EXPERIMENT 2a.

(i) *Purpose, subject and materials.*—(a) The purpose of this experiment was to test the new symmetry hypothesis by seeing if the new predicted order of frequency of appearance of the anomaly agreed with the found order.

(b) *The subject.*—The same subject as in Experiments 1a and 1b was used.

(c) *The material.*—The designs chosen for this experiment were cards in Goldstein-Scheerer, whose main lines of symmetry were *rectangular*, and not

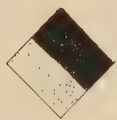
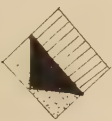
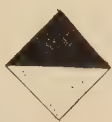
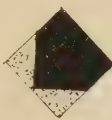
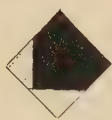
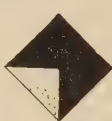
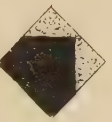
Square Orientation	Diamond Orientation	No.	Square Orientation	Diamond Orientation	No.
		7.			13.
		8.			14.
		9.			15.
		10.			16.
		11.			17.
		12.			

ILLUSTRATION 4.—Showing the designs of figures used in Experiments 2a and 2b.

diagonal. The three designs which fell into this category are shown in Illustration 4.

(d) *Procedure*.—Each figure was presented on the same six types of ground as in the first experiment, the order for each card being determined by a randomly chosen 6×6 Latin Square. In order to increase the reliability of the finding each figure was presented twice, but rotated 90° or 180° as shown in Illustration 4.

(i) The agreement between the predicted and found order was perfect. This is shown by Tables XI and XII. However, the difference between Cards c and d was so small that there might in fact be no real differences.

(ii) The predicted change in the effect of figure was found. The square oriented figure now produced the anomaly 18 per cent. of the trials as against 47 per cent. of the trials for the diamond orientation. This difference was significant at beyond the 1 per cent. level. (See Tables XIII and XIV.)

(iii) The difference between the diamond and the square ground was in the predicted direction, the diamond ground producing anomalies 38 per cent.

TABLE X.—*Total Number of Misorientations for each Card for each Figure.*
Experiment 2a.

Card.	Figure No.						Total anomalies.
	7	8	9	10	11	12	
a	1	0	0	1	0	2	4
b	3	1	2	0	2	1	9
c	4	2	2	2	6	2	18
d	0	1	4	3	4	4	16
Totals	8	4	8	6	12	9	47

For key to designs see Illustration 4.
For key to cards see Illustration 2.

TABLE XI.—*Order of Increasing Frequency of Appearance of the Anomaly for each Type of Card.* (Based on Figure Symmetry Hypothesis.)
Experiment 2a.

Observed order.	Predicted order (in terms of increasing frequency).
a	a
b	b
d	d
c	c

For key to cards see Illustration 2.

TABLE XII.—*Experiment 2a. Frequency of Appearance of the Anomaly.*

Figure orientation.	Ground Shape.		Totals.
	Diamond.	Square.	
Square	9	4	13
Diamond	18	16	34
Totals	27	20	47

Congruent cards = 22. Incongruent cards = 24.
Each cell represents 36 trials. The total number of trials is 144.

TABLE XIII.—*Experiment 2a. Misorientation as Percentage of Trials.*

Figure orientation.	Ground Shape		Totals.
	Diamond.	Square.	
Square	25.0	11.1	18.1
Diamond	50.0	44.4	47.2
Totals	37.5	27.8	32.6

Congruent per cent. = 30.6. Trials per cell = 36.
Incongruent per cent. = 34.7.

S.D. = $\sqrt{pq} = \sqrt{.326(.674)} = \sqrt{.219724} = .468747$

TABLE XIV.

	Difference (in per cent. misorientation).	S.E. difference.	<i>t</i> ratio.	Level of significance.
Square minus diamond ground	-9.7	7.8	-1.244	Not significant*
Square minus diamond oriented figure	-29.1	7.8	-3.731	<1%*
Congruent minus in- congruent cards	-4.1	7.8	-0.526	Not significant*

$$\sqrt{\frac{1}{N_x} + \frac{1}{N_y}} = \sqrt{\frac{2}{72}} = \sqrt{0.027778} = 0.166667$$

* One-tail tests.

of the trials and the square ground 27 per cent. The difference was not significant, even by the one-tail test.

(iv) The relative influence of figure and ground was in the expected direction. A square oriented figure in a diamond ground (Card b) produced anomalies for 25 per cent. of the trials, while a diamond oriented figure in a square ground (Card d) produced anomalies on 44 per cent. of the trials.

(v) No significant difference was found between congruent and incongruent cards. Congruent cards produced the anomaly 31 per cent. of the trials, while incongruent cards produced the anomaly for 35 per cent. of the trials.

EXPERIMENT 2b.

(i) *The materials.*—In view of the possible operation of chance effects, it was decided to repeat the experiment on the same subject. Space forbids a detailed description of this experiment. Suffice it to say that four of the figures with rectangular symmetry were used, two of which (Numbers 16 and 17) were invented and two (Numbers 13 and 15) repeated from Experiment 2a. As a measure of control one figure of diagonal symmetry was inserted into the experiment. This was invented. Figs. 13, 15, 16 and 17 in Table XV are of rectangular symmetry, while Fig. 14 is the control figure of diagonal symmetry.

(ii) *Results.*—An assessment of the results is complicated by the fact that the patient failed in some of the early trials on the new designs. The term failure is used when the patient does not complete the design in three minutes. This is the Goldstein-Scheerer criterion of failure. In one case the patient produced an incorrect design rather than a misoriented design.

The data has, therefore, been tabulated in three ways:

(i) In strict accordance with the statement of theory in Section C above, i.e. every case of a misorientation is shown, and nothing more (Table XV, i).

(ii) Every case of failure is shown, whether it be of misorientation, failure to complete in three minutes, or incorrect reproduction (Table XV, ii).

(iii) The number of anomalies shown by each card only after all failures had ceased, i.e. a degree of learning had taken place (Table XV, iii).

In each case implications of the total results were found to be essentially the same. The total scores gave an order of frequency of appearance of the anomaly for each type of card, which was consistent with the new theory.

The results of three ways of tabulating the data are given in Table XV below. Only the results in Table XV, iii, were analysed in the subsequent Tables XVI, XVII and XVIII.

The results obtained are in conformity with the four hypotheses stated in Section C above. Tables XV (iii), XVI, XVII and XVIII analyse the data obtained for the figures of rectangular symmetry. The influences of figure, ground, and their relative influence when in conflict are all in the expected direction.

Estimates of significance are at the 1 per cent. level for figure symmetry, and at the 5 per cent. level for square ground compared with diamond ground.

The results of Fig. 14, the figure of diagonal symmetry, are also in accordance with the hypothesis. This is shown by the analysis of the data in Tables XIX, XX and XXI. An effective control is thus provided for this test of the symmetry hypothesis. This is because a figure of diagonal symmetry,

TABLE XV. *Experiment 2b. (i) Misorientations only.*

Card.	Figure No.					Totals for 13, 15, 16 and 17.
	13	14	15	16	17	
a .	0	9	0	0	1	. 1
b .	0	7	1	2	1	. 4
c .	9	3	9	10	6	. 34
d .	6	3	9	4	6	. 25
	—	—	—	—	—	—
Totals	15	22	19	16	14	. 64

(ii) *Total Failures.*

a .	0	10	0	2	1	. 3
b .	0	12	1	2	2	. 5
c .	9	5	9	10	9	. 37
d .	6	6	9	4	7	. 26
	—	—	—	—	—	—
Totals	15	33	19	18	19	. 71

(iii) *Misorientation only. (After all failures have ceased.)*

a .	0	5	0	1	0	. 1
b .	0	7	1	1	0	. 2
c .	8	3	7	8	4	. 27
d .	4	1	6	4	2	. 16
	—	—	—	—	—	—
Totals	12	16	14	14	6	. 46

For key to figures see Illustration 4.
For key to cards see Illustration 2.

when used in the same experiment with figures of rectangular symmetry, has still given results consistent with the symmetry hypothesis, i.e. the same order of frequency is found as in Experiments 1a and 1b.

TABLE XVI.—*Experiment 2b (Rectangular Symmetry). Frequency of Appearance of the Misorientation.*

Figure orientation.	Ground shape.		Totals.
	Diamond.	Square.	
Square .	2	1	3
Diamond .	27	16	43
Totals .	29	17	46

(From Table 15 (iii), Figs. 13, 15, 16 and 17.)

Congruent cards = 28 Total trials per cell = 60
 Incongruent cards = 18 Total trials = 240

TABLE XVII.—*Experiment 2b (i) (Rectangular Symmetry). Misorientations as Percentage of Trials.*

Figure orientation.	Ground shape.		Totals.
	Diamond.	Square.	
Square .	3.3	1.7	2.5
Diamond .	45.0	26.7	35.8
Totals .	24.2	14.2	19.2

(From Table XV (iii).)

Trials per cell = 60 Congruent per cent. .. = 23.3
 Incongruent per cent. .. = 15.0

$$\text{S.D.} = \sqrt{pq} = \sqrt{.192 (.808)} = \sqrt{.155136} = .393873$$

TABLE XVIII.—*Experiment 2b (ii) (Rectangular Symmetry).*

	Difference (in per cent. misorientation).	S.E. difference.	t ratio.	Level of significance.
Square minus diamond ground . . .	-10.0 . .	5.1 . .	-1.961 . .	<5%*
Square minus diamond oriented figure . .	-33.3 . .	5.1 . .	-6.529 . .	<1%*
Congruent minus in- congruent cards . .	8.3 . .	5.1 . .	1.627 . .	Not significant*

(From Table XV (iii).)

$$\sqrt{\frac{1}{N_x} + \frac{1}{N_y}} = \sqrt{\frac{2}{120}} = \sqrt{.016667} = .129101$$

* One-tail test

TABLE XIX.—*Experiment 2b (i) (Diagonal Symmetry).*

Figure orientation.	Ground shape:		Totals.
	Diamond.	Square.	
Square . .	7 .	5 .	12
Diamond . .	3 .	1 .	4
	—	—	—
Totals . .	10 .	6 .	16

(From Table XV (iii), Fig. 14.)

Total trials	= 60	Congruent	= 8
Trials per cell	= 15	Incongruent	= 8

TABLE XX.—*Experiment 2b (ii) (Diagonal Symmetry).*

Figure orientation.	Ground shape.		Totals.
	Diamond.	Square.	
Square . .	46.7 .	33.3 .	40.0
Diamond . .	20.0 .	6.7 .	13.3
	—	—	—
Totals . .	33.3 .	20.0 .	26.7

(From Table XV (iii), Fig. 14.)

Congruent %	= 26.7	Incongruent %	= 26.7
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S.D. = $\sqrt{pq} = \sqrt{.267(.733)} = \sqrt{.195711} = .442392$

TABLE XXI.—*Experiment 2b (ii). (Diagonal Symmetry).*

	Difference (in per cent. misorientation).	S.E. difference.	t ratio.	Level of significance.
Square minus diamond ground . . .	—13.3 .	11.4 .	—1.167	Not significant*
Square minus diamond oriented figure . .	26.7 .	11.4 .	2.342	<1%*
Congruent minus in- congruent cards . .	0 .	11.4 .	0	Not significant*

(From Table XV, iii, Fig. 14.)

$$\sqrt{\frac{1}{N_x} + \frac{1}{N_y}} = \sqrt{\frac{2}{30}} = \sqrt{.066667} = .258200$$

* One-tail test.

E. DISCUSSION.

In evaluating the results it is necessary to do two things. First of all, it is necessary to indicate any relationships between the facts reported here and other facts in the field of perception. Secondly, it is necessary to examine the methodological implications of the experiments reported here.

I. THE FINDINGS AND OTHER FACTS OF PERCEPTION.

It is not the aim, at this stage, to present an exhaustive study of the relevant literature. The intention here is merely to indicate the possibility that the

phenomena studied in this paper are related to other facts of perception in normals. Three examples will be given.

First of all, there is at least one finding which appears to be related to the symmetry hypothesis. This is Bakay and Schiller's (1) finding that normal subjects, when faced with a figure which they were asked to turn into any position, almost invariably turned the figure into a position in which the lines of symmetry were parallel with either the vertical or horizontal axis of the visual field.

The second example indicates the possibility that the influence of diamond and square grounds is related to the different psychophysiological properties of the perceived diamond and square. Koffka reports that Hartmann found that the critical fusion rate for a flickered plain square increases when it is turned into the diamond position (5).

The third example indicates that there is in normals a relationship between the orientation of a design and its perceptual distortion. This can be demonstrated by the Poggendorf illusion (Illustration 6). It is minimized when the interrupted line A B is in a vertical or a horizontal position, and maximized when the line A B is $\pm 45^\circ$ to the vertical or horizontal position (2).

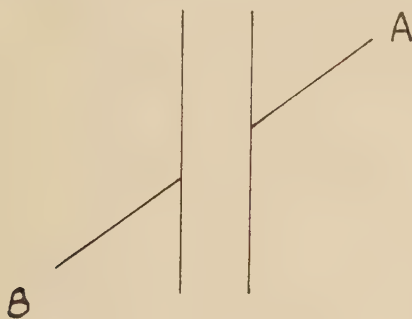


ILLUSTRATION 6.

Findings such as these indicate the possibility of subsuming under the same general laws anomalies shown by psychiatric patients and perceptual anomalies found in normals. This possibility has already been demonstrated by Teuber and Bender (7).

2. METHODOLOGICAL IMPLICATIONS.

The validity and usefulness of the investigation of the single case would seem to depend on three main criteria. The first one is that the phenomena concerned must be brought under control. Thus, in the case reported here, the relative frequency of the appearance of the anomaly was related to precise and definable conditions of organization of the stimulus field.

The second criterion is that the hypotheses developed must make possible precise predictions of behaviour or experience under new conditions and

predictions of phenomena which have not been observed before. For example, in the case reported here it was possible to reverse the effect of the orientation of the figure on the basis of the symmetry hypothesis, and to create new designs whose effects on the patient were correctly predicted.

The development of the power of prediction in the single case over a wide range of phenomena is surely just as valid an aim for science as the demonstration of an hypothesis in a large number of cases. Which of these courses is taken must depend on the investigator's purpose, and the particular stage of development of the branch of knowledge concerned.

When such predictive power is developed, the findings cannot be ascribed to mere chance, nor can they be said to be capable of application only to the particular case, for any general theory must cover this case as well. For example, the finding in these experiments that a notion of summative relations between figure and ground, and not Gestalt relations, allowed prediction, is a finding of which Gestalt theory must now take account. An exception has been found to the Gestalt theory which can provide a pivotal point for further experimental inquiry.

The third criterion is that the hypothesis developed must provide at least the beginnings of an explanation of the phenomenon concerned. It must be directed at answering the question, "How did the phenomenon occur?" In the experiments reported here, we obtain some idea of the conditions affecting the patient's performance on the Block Design Test. This lays the basis for the development of hypotheses concerned with the actual processes involved.

Thus, one may conclude that the considerations affecting the validity and fruitfulness of the experimental attack on the single case are the same as those affecting the use of many cases. These are the considerations of control, predictive power, and concern with process. Control is achieved when it is possible so to manipulate the situation that the behaviour of the subject always changes in a predicted way. Thus in Experiment 1a Card b invariably produced the anomaly, while card d never did. This is an extreme example, but it illustrates the point.

Once an event has been brought under experimental control a variety of things can be done about it. A large range of questions can be asked, such as: Does the phenomena occur in different people and in different nosological groups? Do similar phenomena occur in other aspects of perception and in other modalities? A variety of interesting facts can be gathered. If, however, the concern is with process, then the main effort would be directed at the development and the experimental testing of how the phenomenon actually occurred.

Further examples of experiments with the single case can be found in an article by J. Zubin (8), and some of the statistical problems involved have been discussed in the *Journal of Clinical Psychology* (6).

F. CONCLUSIONS.

1. One conclusion emerging from these experiments is that it is possible for figure and ground to maintain their separate characteristics when entering into relationships with each other, and that their relationship is summative,

and not Gestalt-like in character. The conception of congruence between figure and ground did not account for the observed rank order of frequency of misorientations, or in any consistent manner for the results. The findings appear to be in complete disagreement with the following quotation from Koffka (5)—“ It has been said : The whole is more than the sum of the parts. It is more because summing is a meaningless procedure, whereas the whole-part relationship is meaningful.”

It must be pointed out, however, that the Goldstein-Scheerer hypotheses were not initially devised to predict the frequency of the appearance of anomalies. They commit themselves only to the time taken to reproduce a given design correctly with the Kohs Blocks. The experiments described in this paper therefore do not directly contradict the Goldstein-Scheerer hypotheses. They were only shown to be inadequate as a basis for the prediction of the frequency of misorientations.

2. The second general finding is that the more obvious “ phenomenal ” notions of good form or “ *pregnanz* ” are not very useful for precise investigation. Goldstein and Scheerer believe that a design which is squarely oriented has a better form than one which is diamond oriented. In fact, it was found that for the patient in question it was the line of symmetry which determined which orientation of design would produce more anomalies. But the line of symmetry itself could also be subsumed under the notion of “ good form.” This lack of precision of conception is brought out by Koffka’s own definition. On page 110 (5) he states “ psychological organization will always be as good as the prevailing conditions allow. In this definition the term ‘ good ’ is undefined. It embraces such properties as regularity, symmetry, simplicity, and others.” We have thus a definition in which the most important term is explicitly undefined.

3. Thirdly, as has been noted in Section E (1) above, these experiments indicate the possibility that abnormal perceptual function is subject to general laws similar to those of normal function. For the clinical psychologist, knowledge of these laws and of the way in which abnormal function differs as well as resembles the normal, is one of the most important objectives.

4. Fourthly, as they stand the results do not indicate whether the perceptual anomaly shown by the patient was in any way related to her left-sided hysterical disorder. The examination of all the patients in whom this anomaly is found will enable us to develop on this question theories which are capable of being tested by experiment. We already have experimental data on nine other patients, and this data will be duly examined.

5. Finally, and most important of all, it has been proved possible, by manipulation of visual material, to control experimentally the relative frequency of appearance of an anomaly of spatio-motor function. It has been possible to maximize its frequency of appearance and to minimize it almost to zero. Secondly, it has been possible to reverse the apparent conditions under which the anomaly appeared. Where before it appeared for a square oriented figure, it now appeared for a diamond oriented figure and vice versa. To begin to control a phenomenon in relation to explicit hypotheses is to lay the basis of understanding it.

Further investigation should not be confined merely to the initial observation, to doing what might be called "perceptual tricks" with psychiatric patients. The aims for further investigation must be to subsume the data obtained under the most general laws of function, thus giving the widest possible range of predictive power in both normals and abnormals, and to provide a possible basis for an experimental definition of the dysfunction involved in the disorder of some psychiatric patients.

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A CENTRAL HOMEOSTATIC MECHANISM IN SCHIZOPHRENIA.*

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THE condition of physiological homeostasis results from the maintenance of a *steady state* for the functions of organs and the levels of different blood constituents, despite the constant variability of other factors from without and within tending to upset that *steady state*. Most organs of the body show variability and adjustment of their functions in the presence of stresses, but the brain cannot itself make such adjustments. Yet any change in the external or internal environment of the body affects the brain, and particularly the cortex, most severely. Homeostatic mechanisms function as defensive mechanisms, protecting the cortex of the brain from harmful alterations in the internal environment.

Peripheral adjustment (homeostatic) mechanisms often involve only chemical factors. For example, the experience of hunger is due to increased gastric peristalsis, itself dependent upon hypoglycaemia. An intravenous injection of sugar reduces gastric motility and the experience of hunger disappears. Again, the secretion of glucose by the liver depends, among other things, upon the concentration of sugar in the blood reaching it. With a low blood sugar the liver mobilizes more glucose from its glycogen; with a high blood sugar, the glucose production of the liver declines. These chemical mechanisms occur slowly, and the threats which they encounter are not severe. When, however, the threat produced by a change is more serious, and particularly when it involves the functions of the cerebral cortex, more rapid homeostatic defensive reactions are called for. In all such cases the autonomic and central nervous systems are involved. For example, during severe muscular exercise there is an increased venous return to the heart. This is met by a reflex acceleration of the heart and by peripheral vasoconstriction. This would mean a rise in blood pressure if this were not immediately counteracted by the aortic and carotid sinus reflexes. Where the threat to the functions of the cerebral cortex is severe, as occurs, for example, in anoxia or in rapidly progressive hypoglycaemia, an "emergency" response of the autonomic system is seen. Although both elements, sympathetic and parasympathetic, undergo discharge, the former predominate, and characteristically a mass discharge of the whole sympathetic system is witnessed. Intrinsic to the mechanism is the activation of the adrenal medulla, so that this reaction is

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termed the sympathetic-adrenal discharge. The integration and organization of this homeostatic mechanism is believed to lie in the hypothalamus.

METHODS OF TESTING HOMEOSTASIS.

There are two main types of test in common use for testing the homeostatic defences :

(1) In the one the *levels* of those blood constituents, which are normally held constant by homeostatic mechanisms, are examined, e.g. blood sugar, pH or CO₂ concentration, or the levels at which different functions are set are estimated, e.g. blood pressure, temperature, B.M.R., heart rate and muscle tone.

(2) In the second type of test the organism is submitted to a measured alteration in one of its functions, and the homeostatic defensive response to this alteration is measured. This response can be considered as to whether it is—

(a) Adequate to restore the *steady state* for the function altered.

or, (b) Whether the restoration of the steady state is prompt, or whether it is delayed and defective in this sense.

DEFECTIVE HOMEOSTASIS IN SCHIZOPHRENIA.

Schizophrenics have frequently been examined by both these methods. The results have been summarized by Hoskins (1946) and by Gellhorn (1942). The levels at which different functions are set in schizophrenics are usually normal. Exceptions to this general statement are nutritional status, oxygen consumption, rate of blood flow, basal systolic blood pressure, pulse rate, colon emptying time, and urine output. Hoskins emphasizes that although simple tests of different functional levels in schizophrenics will usually give values lying within a normal range of variability shown by controls, the capacity for such patients *to hold to the steady state for most functions is defective*. The simplest way to establish this is to compare the standard deviation of the means for the values of the function between a group of patients and controls. Such studies indicate that—to quote Hoskins—for many “metabolic functions the average variability in schizophrenics ranges from almost one and a half more to twice that in normal persons of similar ages.”

The central elements in homeostatic defences, those involving the upper reaches of the central and autonomic nervous systems, cannot be sorted out by this statistical method, which only gives an all-over picture. Nor indeed can one infer a defective functioning in the homeostatic mechanisms from the demonstration of such variability. Miller (1936), for example, showed that the increased urinary output of schizophrenics must be ascribed to their attitudes to water drinking. The second method cited does, however, enable the workings of such elements to be detected. Faulty responsiveness to stress factors in schizophrenics has been observed by a number of workers. The changes in systolic blood pressure and pulse rate after intravenous adrenalin are significantly less in schizophrenic patients (Freeman and Carmichael, 1935). A number of studies (Hoskins and Sleeper, 1930 ; Cohen and Fierman, 1938)

also demonstrate a similar lack of reactivity to the ingestion of thyroid extract. The tolerance of high doses of thyroid extract—as much as 18 grains a day—is a familiar observation made on these patients. Freeman and Rodnick (1940) found very little response in the blood pressure, heart rate and respiration of schizophrenics to the severe stress of inhaling warm moist oxygen, which prevents heat loss from the lungs. On the other hand, the results in over a quarter of the normal controls were so alarming that the experiments had to be terminated. The cardiovascular adjustment mechanisms in response to exercise and changes of posture are poor in schizophrenics (Linton, Hamelink and Hoskins, 1934). The capacity of schizophrenics to regulate their temperature on exposure to cold is also poor (Finkelman and Stevens, 1936). The response to all these stresses involves the activities of the autonomic nervous system. The evidence from many sources is of “a sluggishness of sympathetic reactivity” (Hoskins, 1946). Gellhorn (1942) states that schizophrenics show not only a decreased reactivity of the sympathetic-adrenal system, but also a relative preponderance of the vago-insulin system. The question next arises whether the defect in the nervous mechanisms lies in the periphery or in the higher integration levels, such as the medulla and diencephalon. The peripheral and local vasomotor reflexes in schizophrenics, investigated by Jung and Carmichael (1938), Myerson and others (1937), are normal. Much of the evidence in fact points to a reduced excitability of the higher sympathetic centres, probably those in the diencephalon.

SELECTION OF A STRESS TEST.

It was therefore decided to submit schizophrenics to a homeostatic stress, the adjustment to which would involve the excitability of the sympathetic-adrenalin system, and which would also constitute a significant threat to the functions of the cerebral cortex. From among the possibilities (such as oxygen saturated with water vapour, anoxia and hypoglycaemia) insulin hypoglycaemia was chosen for the following reasons: Apart from its safety, hypoglycaemia progressively depresses the functions of the central nervous system and excites the function of the autonomic system. After an intravenous injection of insulin the blood sugar falls progressively and fairly rapidly for the first 25 minutes or so, and these changes are sufficiently slow to enable continuous observation to be made on the cerebral cortex by means of the E.E.G., and upon the autonomic nervous system by other electrical methods. Significant changes in the excitability of both cortex and autonomic system occur before any real change in the patient's consciousness is apparent. This is not the case with anoxia, in which the changes in cortical function seen in the E.E.G., the sympathetic adrenalin discharge and the loss of consciousness follow one another with great rapidity. Hypoglycaemia also has the advantages that a considerable amount is known about its physiology.

After an intravenous injection of insulin to a fasting subject, the blood-sugar level declines progressively to reach approximately half the fasting level at about 25 minutes. At this point the level begins to rise again quite sharply for a further 3–5 minutes, and then varies about this level. The rise in



FIG. 1b.—Shows three cuts from the continuous record of the second group of pens described in Fig. 1a. These were taken at the start, at the point of change in the E.E.G. and a few minutes later. The upper trace is a signal marker, which in the second strip marks the occasion when the patient's ear was pricked for blood sample. Note the sudden fall in palmar skin resistance necessitating a change of range, the increased heart rate, the large amount of theta rhythm seen in the primary trace, which is shown by the tuned amplifier pen measured by its integrator circuit.

the level of the blood sugar at about 25 minutes is brought about by homeostatic adjustment mechanisms, prominent among which is the sudden mass discharge of the sympathetic-adrenalin system, which occurs 2 to 5 minutes before the rise in the blood-sugar curve. Undoubtedly the secretion of adrenalin as a result of this mass sympathetic discharge is responsible for the mobilization of glycogen, and this for a time halts the progressive hypoglycaemia. After small doses of insulin, it may indeed result in a slow restoration of the fasting blood-sugar level. The integration of the mass sympathetic discharge is generally held to be in the diencephalon. Of interest in the experiments was the possible integration of the functions of somatic and autonomic nervous elements in the brain. Since in hypoglycaemia the functions of the somatic elements undergo depression, recognized finally by the appearance of slow waves in the E.E.G., and the functions of the A.N.S. undergo excitation, seen finally by the mass sympathetic adrenalin discharge, how are these two alterations related? Are they independent of one another or does one succeed the other, or are they mutually dependent? Since the functions of the cerebral cortex (somatic) are inhibitory on the excitability of the autonomic centres in the diencephalon, one would expect hypoglycaemia, which depresses the cortex and excites the diencephalon, to demonstrate such relationships, if they exist. This, in fact, has proved to be the case.

METHODS.

In these experiments changes in the functions of the cerebral cortex were recorded by means of the E.E.G. The sympathetic-adrenalin discharge was recognized by the sudden fall in the electrical resistance of the skin of the palm of the hand, which was recorded throughout, and by the rise in heart rate recorded by the E.C.G. Values for each of these variables were obtained every 15 seconds throughout the experiments.

Induced hypoglycaemia.—A standard dose ($\frac{1}{2}$ unit per lb. body weight) of insulin was injected intravenously to fasting subjects. Capillary blood was taken from the ear lobe before and at 10, 15, 20, 22, 25, 28 and 30 minutes after injection. The blood sugar was estimated by the Hagedorn-Jensen method. At 30 minutes or before if gross changes had occurred in the E.E.G., the hypoglycaemia was terminated by 100 c.c. 33 per cent. glucose intravenously. The clinical signs of hypoglycaemia encountered during this procedure included pallor, raised heart rate and sweating. No significant alterations of consciousness were apparent, although a few subjects stated that they felt drowsy or "far away" before termination.

Recording methods.—Before and throughout the 30 minutes after injection of insulin and until the E.E.G. had returned to normal after glucose injection the following recording was made:

1. Electroencephalographic records from bipolar electrodes placed in pairs on the frontal, central and occipital areas on the left side of the head, the electrodes being placed transversely to the sagittal line of the head.
2. Continuous record of the E.C.G. between the right wrist and the left ankle.

3. Continuous record of the palmar galvanic skin resistance (G.S.R.) of the right hand.

The electroencephalograms were taken with a standard 3-channel Grass or a 6-channel Ediswan Electroencephalograph, operating ink-writing oscillographs. In addition to the primary record, the output voltage of one channel (either from frontal or central electrodes) was applied, via an attenuator, to a sharply tuned amplifier, usually tuned to 6 c/sec. The output of this, in turn, was rectified and caused a condenser to receive a charge. Every 15 seconds the

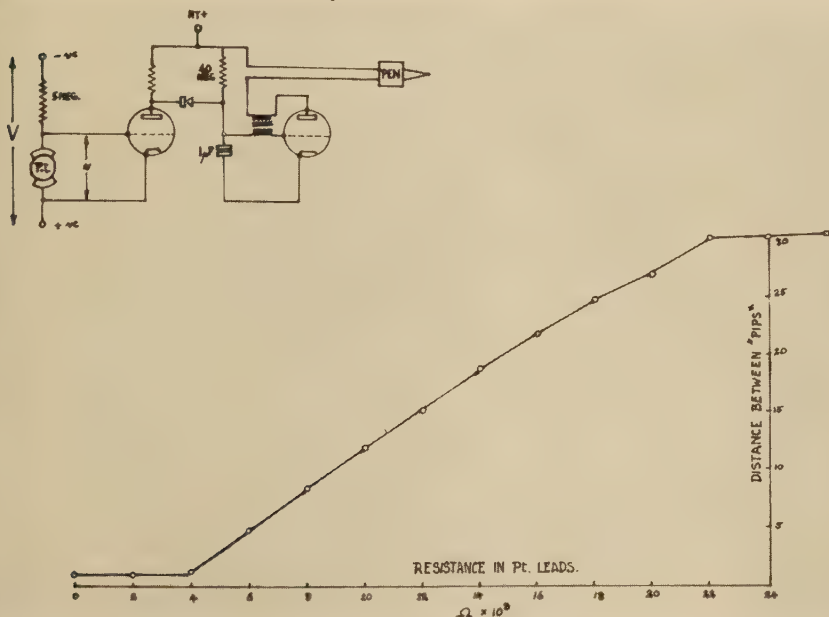


FIG. 2a.—Schematic diagram of circuit used to record the galvanic palmar skin resistance, and a calibration curve for the apparatus. The bias voltage of the amplifying valve could be altered by a switch. In this way resistances up to 500,000 ohms were measured in ranges of 20,000 ohms each.

condenser was discharged through a high resistance, and the time required to do this was recorded by two marks on the moving paper. Thus the greater the amount of activity at the pair of electrodes at the frequency to which the amplifier was tuned, the greater the distance between the two marks at the end of the 15-second epoch (Fig. 2b).

MEASUREMENTS OF SKIN-RESISTANCE.

The two electrodes used were a flat copper disc the size of a penny, pressed uniformly on the palm of the hand, and a plate strapped on the wrist after the latter had been treated with abrasive electrode jelly. A constant potential was applied to a large resistance of 5 meg. and the resistance of the patient joined in series. Since the total resistance remained practically constant the current did also, and the potential difference at the electrodes could be taken to represent the palmar-skin resistance. This potential was amplified by a

single amplifier valve. The amplified voltage, representing skin-resistance, was applied as bias to a voltage-limiting diode, controlling the charge in the blocking condenser of a blocking-oscillator. The pulse-time of the oscillator was proportional to the diode bias and so to the required skin resistance. A pen-marker bobbin in the anode of the blocking oscillator caused marks to be made on the *fairly* fast moving recording paper. The distance between adjacent marks was thus in linear proportion to the skin-resistance. The range of resistance from 0.5 megohm was divided into a number of smaller ranges,

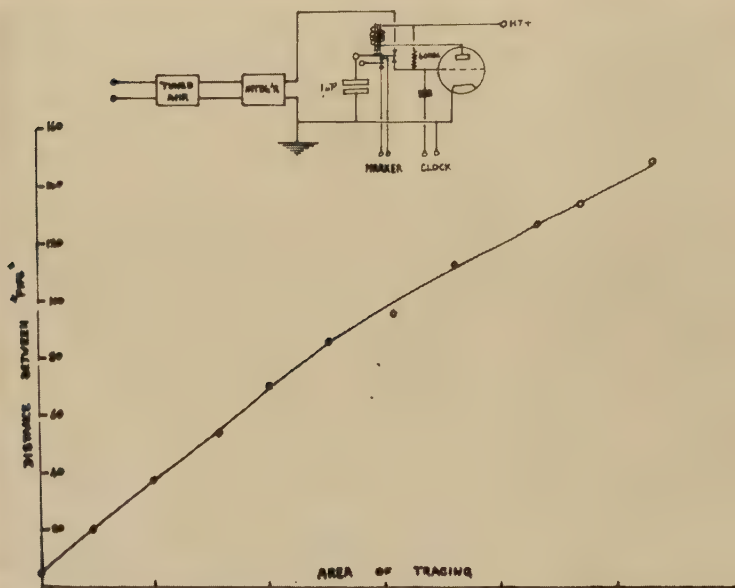


FIG. 2b.—Schematic diagram of circuit used to record the amount of theta-rhythm, together with a calibration curve. The condenser was charged by a current proportional to the output of a sharply tuned amplifier. Every 15 sec. an impulse from a clock caused the relay to be released. The condenser was then discharged through the high resistance, and, when it was reduced to a certain value, the relay became reactivated. The instant of release and reactivation was marked on the record.

selected by a switch which applied an appropriate bias to the amplifying valve (Fig. 2a).

Figs. 1a and b illustrate the general plan of the recording methods. Two recording papers were used, locked by common time and signal markers. In addition, in some experiments automatic frequency analysis by the Walter method was superimposed on the primary E.E.G. record.

CLINICAL MATERIAL.

Seventeen normal subjects were examined, 14 of whom were colleagues who volunteered. The age range was from 20 to 41. Selection was made on the basis of a normal E.E.G., and freedom from any condition likely to influence the record, such as head injury.

Forty schizophrenics have been examined, but a few on many occasions, so that the total number of experiments on schizophrenics is about 150. The patients have been divided into two groups, "recent" in the sense that the illness is of less than 2 years' duration, or if longer, intermittent and mild in

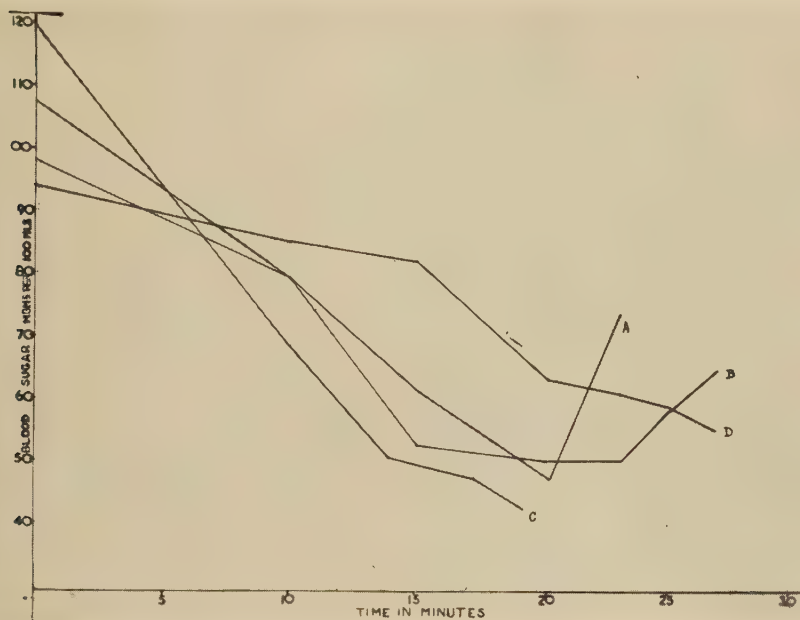


FIG. 3.—(a) Four main types of blood-sugar curve encountered after intravenous insulin, identified from the massed blood-sugar curve of 17 cases (Fig. b).

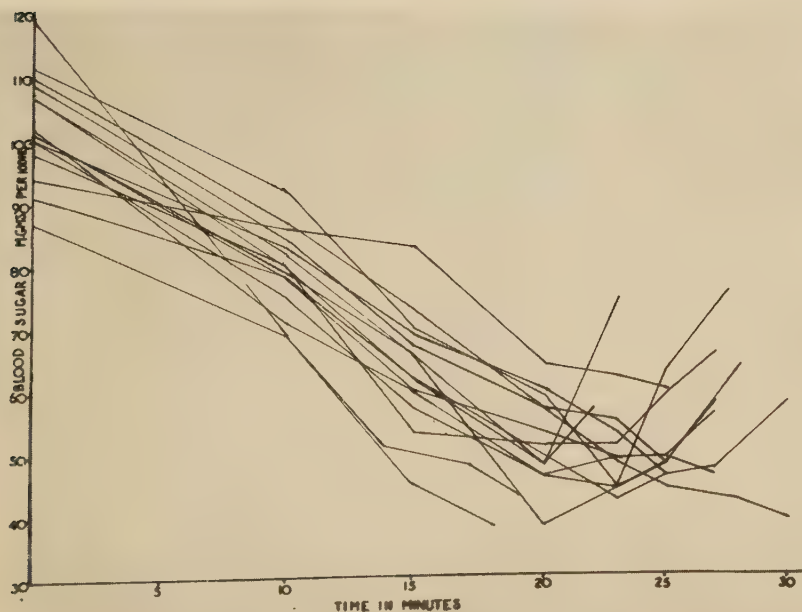


FIG. 3b.

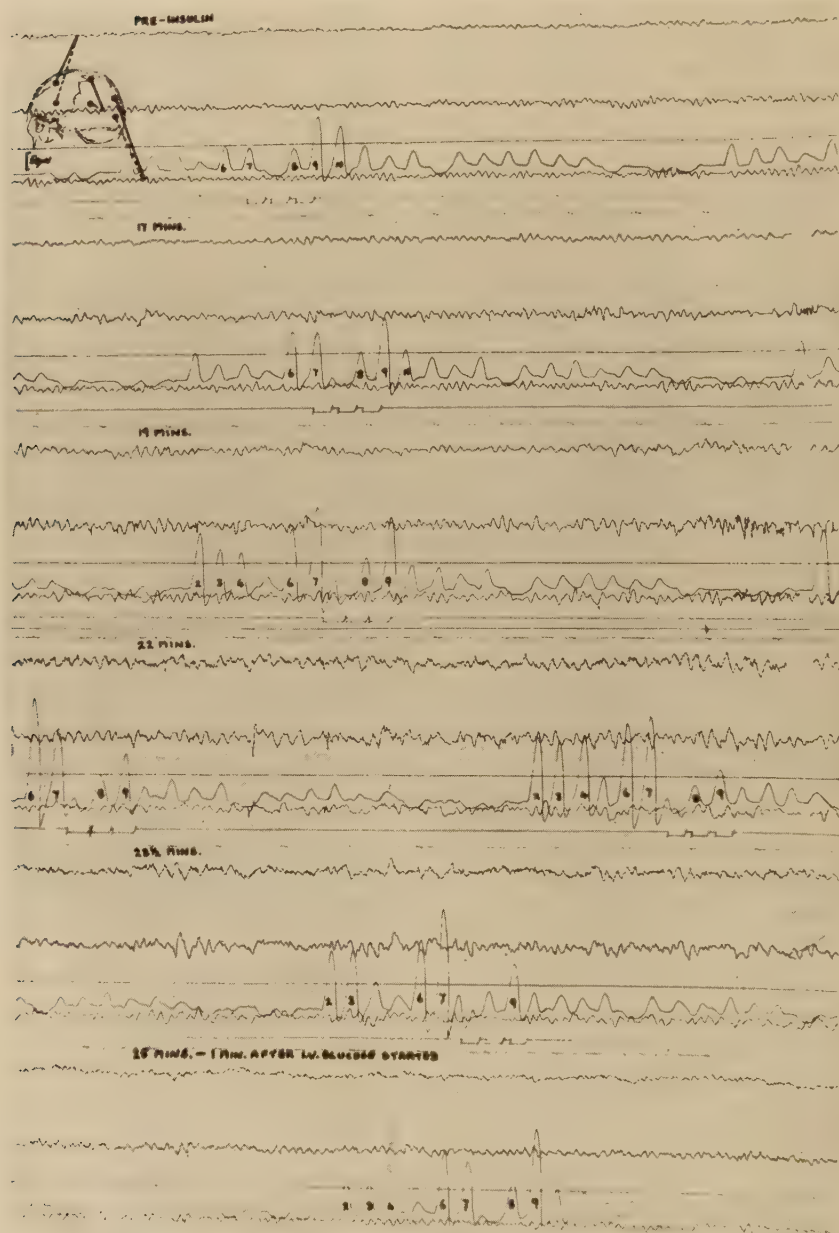


FIG. 4.—E.E.G. changes in two normal subjects during hypoglycaemia induced by intravenous insulin. (a) Strips of record taken before injection, at 17, 19, 22, 23½ and 25 minutes after injection, the last 1 minute after intravenous glucose. Automatic frequency analysis of the third channel is superimposed. A change in both primary trace and analyser trace is seen at 19 minutes, but becomes continuous in records from frontal and central areas at 22 minutes. At 23½ minutes there is less slow activity in the record, and at this time the blood-sugar level has begun to rise. Recovery of the normal E.E.G. pattern is very rapid after intravenous glucose. (b) as in (a), but having a change to dominant 3 c/sec. activity in frontal and central areas at 22 minutes.

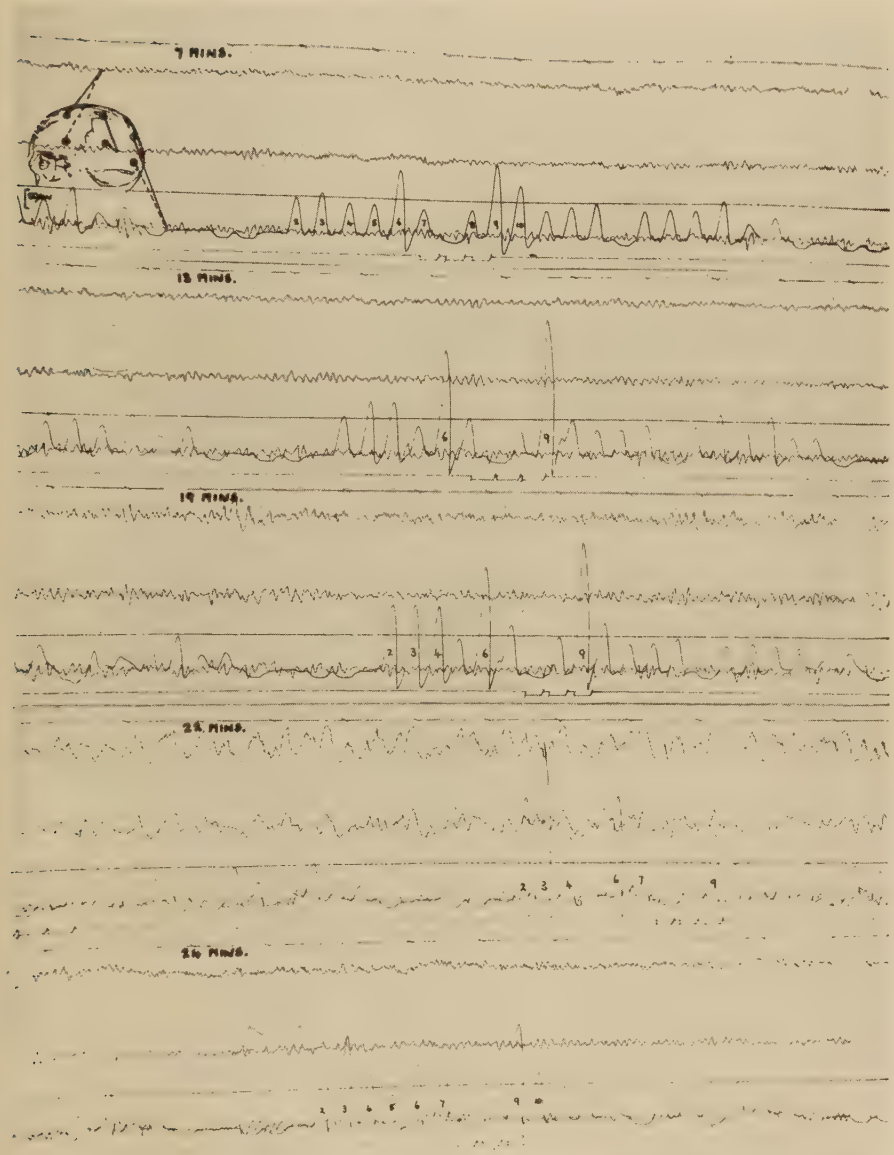


FIG. 4b.

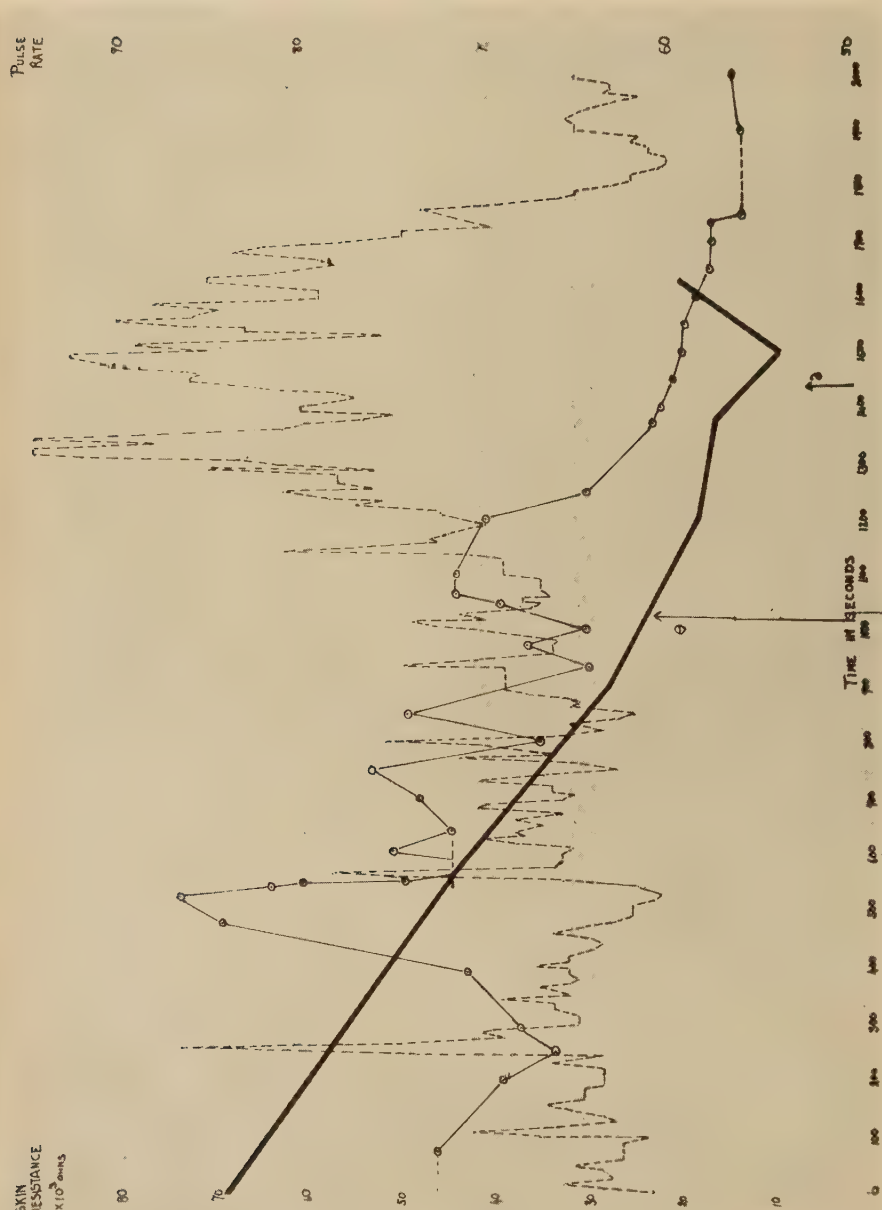


FIG. 5.—Graphs showing the changes in heart rate (—●—●), palmar skin resistance (—○—○), and blood-sugar level (—) after intravenous insulin in a normal subject. The first appearance of theta (θ) rhythm in the E.E.G. occurred at 16½ minutes. The changes in heart rate and skin resistance mirror one another. Note that the order of events is (1) appearance of theta rhythm, (2) fall in heart rate and skin resistance, (3) rise in blood-sugar level.

character ; and “ chronic ” in the sense that all subjects so included had been in a mental hospital for five years or more.

RESULTS.

Normal Subjects.

Fig. 3*b* gives the blood-sugar curves for 17 controls. These can be classified into four types according to the rapidity of fall and recovery of the blood-sugar level. Ten cases fell into type A, 3 cases into types B and C respectively, and 1 case type D (Fig. 3*a*). When the blood-sugar level failed to fall within 2 mgm. per cent. of half the fasting level within 25 minutes, the subject has been called insulin resistant. Only 1 normal subject (type D) was insulin resistant according to this criterion. An inverse relationship between changes of heart rate and skin resistance was found in most cases. In 12 of the 14 normal subjects, on whom the data is complete, the order for change was :

- (1) A change in E.E.G. characterized first by *slowing* of the alpha (occipital 8-13 c/sec.) activity by 1-1½ c/sec., followed by—
- (2) The appearance of a *new* rhythm at 5-6 c/sec. in the frontal or central areas (Figs. 4*a* and *b*).
- (3) Within a short but variable time (¼-3 minutes ; usually between 1-2 minutes) a rapid fall in skin resistance and rise in heart rate, and—
- (4) A rise in the blood-sugar level within a further variable time of 1-8 minutes (mean 4 min.) (Fig. 5).

In 3 normal subjects the measurement of skin resistance was not obtained, but in 2 of the 14 this changed just prior to the E.E.G. change. In one case (No. 10) the fall in skin resistance was gradual, but began before the cortical changes ; in the other (No. 12) the fall was abrupt and preceded the E.E.G. change by 4½ minutes.

Schizophrenics.

Forty schizophrenics have been examined, but 8 patients have together provided 103 experiments. In 24 experiments the patients were found insulin resistant, the blood sugar not falling to within the range at which E.E.G. changes could be anticipated (type D). These are, therefore, excluded. Of 40 patients, 26 were “ recent ” cases, and 14 were chronic by the criteria already described.

Comparison between the response of the controls and schizophrenics demonstrates the following differences :

- (1) The level of blood sugar at which the 5-6 c/sec. activity appears in the frontal and central E.E.G. is significantly lower in the schizophrenic group (Fig. 6).

FIG. 6.

	Mean fasting B.S. mgm. %.		Mean B.S. at E.E.G. change.		Mean time of change (min.).
Controls (17)	100	.	52·2	.	19·5
	(S.D. 9·4)	.	(S.D. 7·4)	.	(S.D. 3·16)
Schizophrenics	93·0	.	44·0	.	25·0
(69 expts.)	(S.D. 9·9)	.	(S.D. 7·4)	.	(S.D. 3·84)

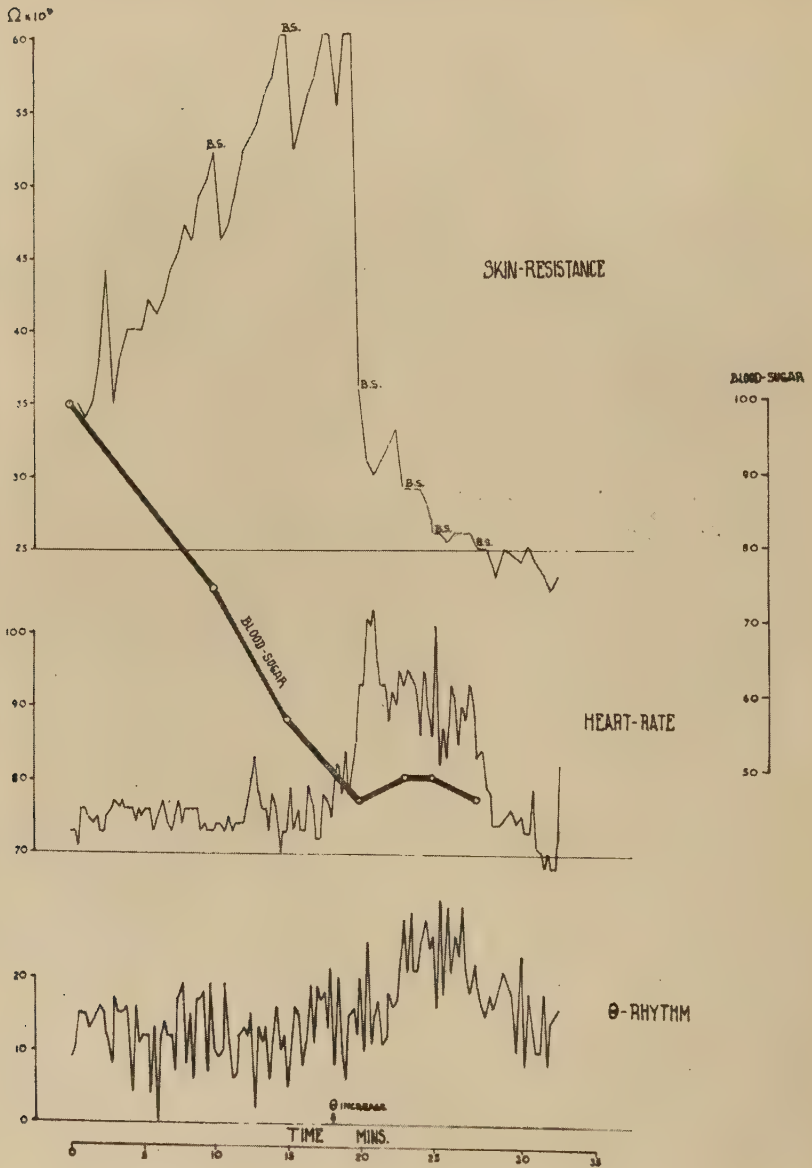


FIG. 7.—Results from a normal subject—compare with Fig. 8, results from a chronic schizophrenic patient. In Fig. 7 the theta rhythm change occurs at 18 minutes, is immediately followed by the fall in G.S.R. and rise in H.R., and then by the rise of blood-sugar level at 20 minutes. In Fig. 8 the rise of blood-sugar level occurs *first* at 20 minutes, *followed* by appearance of theta rhythm at 25 minutes and fall of G.S.R. and rise of H.R. after this.

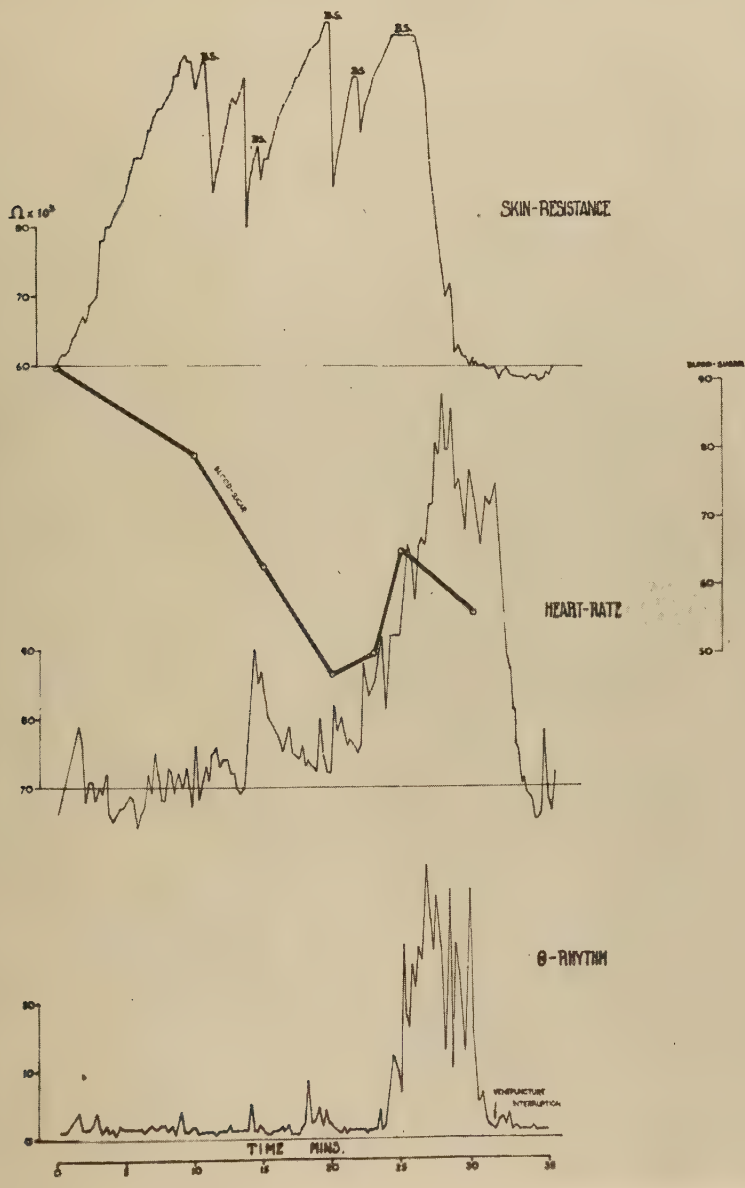


FIG. 8.—Compare Fig. 7 (see legend). Results from a chronic schizophrenic patient.

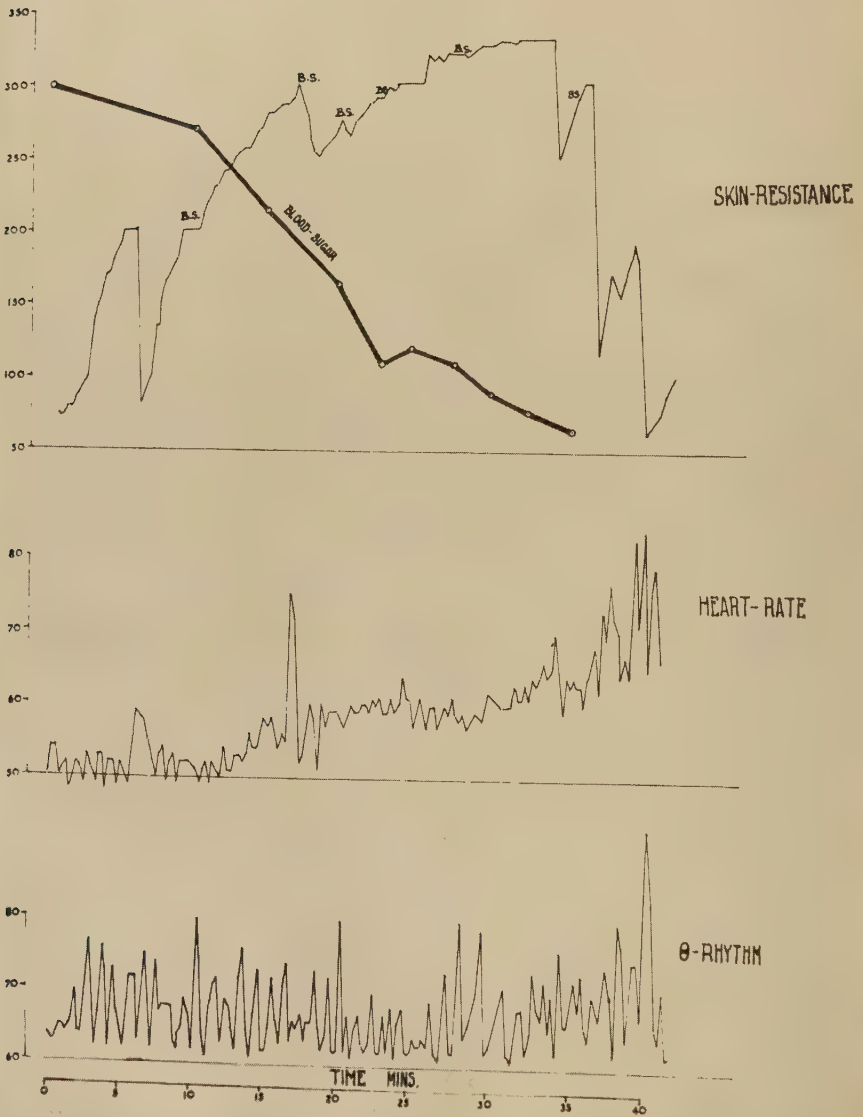


FIG. 9.—Results from a chronic schizophrenic patient. The responses of the theta rhythm, heart rate and galvanic skin resistance are late and not integrated. The homeostatic rise in blood-sugar level is also defective. (Blood-sugar levels are not given—at 40 minutes this had fallen to 35 mgm. per cent.)

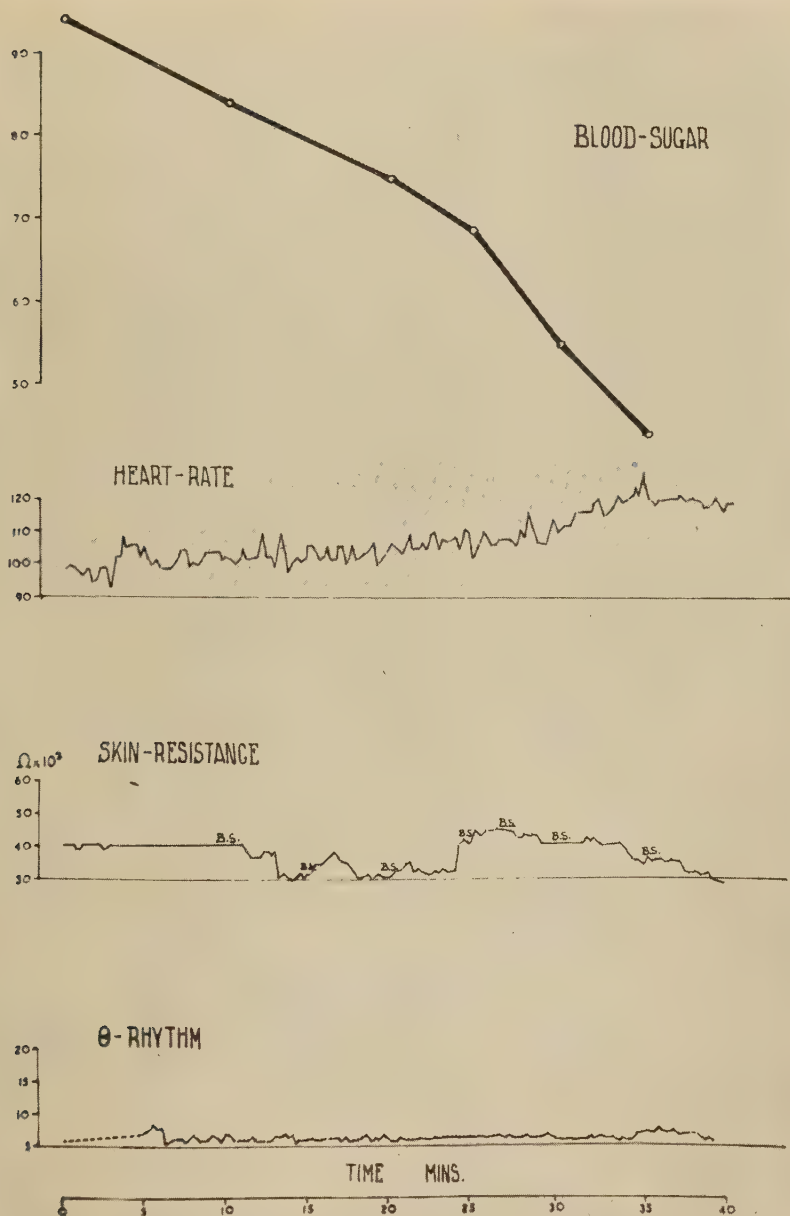


FIG. 10.—Results obtained from a patient in catatonic stupor. No change in the E.E.G., heart rate or galvanic skin resistance occurred. The blood-sugar level shows no homeostatic rise, and at 35 minutes had fallen to 43 mgm. per cent.

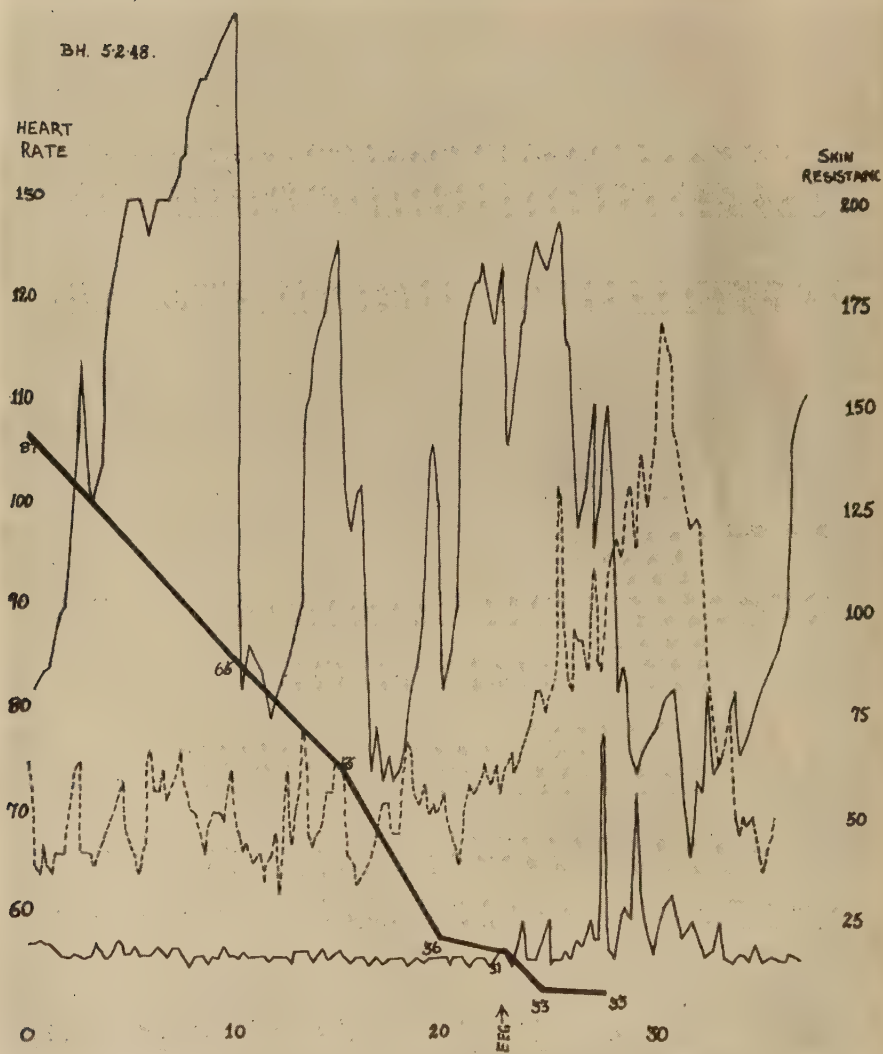


FIG. 11.—Same subject as in Fig. 10, two months later. The mental state was now normal. Theta rhythm appears at 22 minutes, and is followed by a fall in G.S.R. and rise in H.R., but the blood sugar has fallen to 33 mgm. per cent.—a very low level not encountered among controls. Note also the great lability of the G.S.R. throughout the experiment at the times of blood withdrawals, in contrast to the absence of any such changes during the previous experiment (Fig. 10).

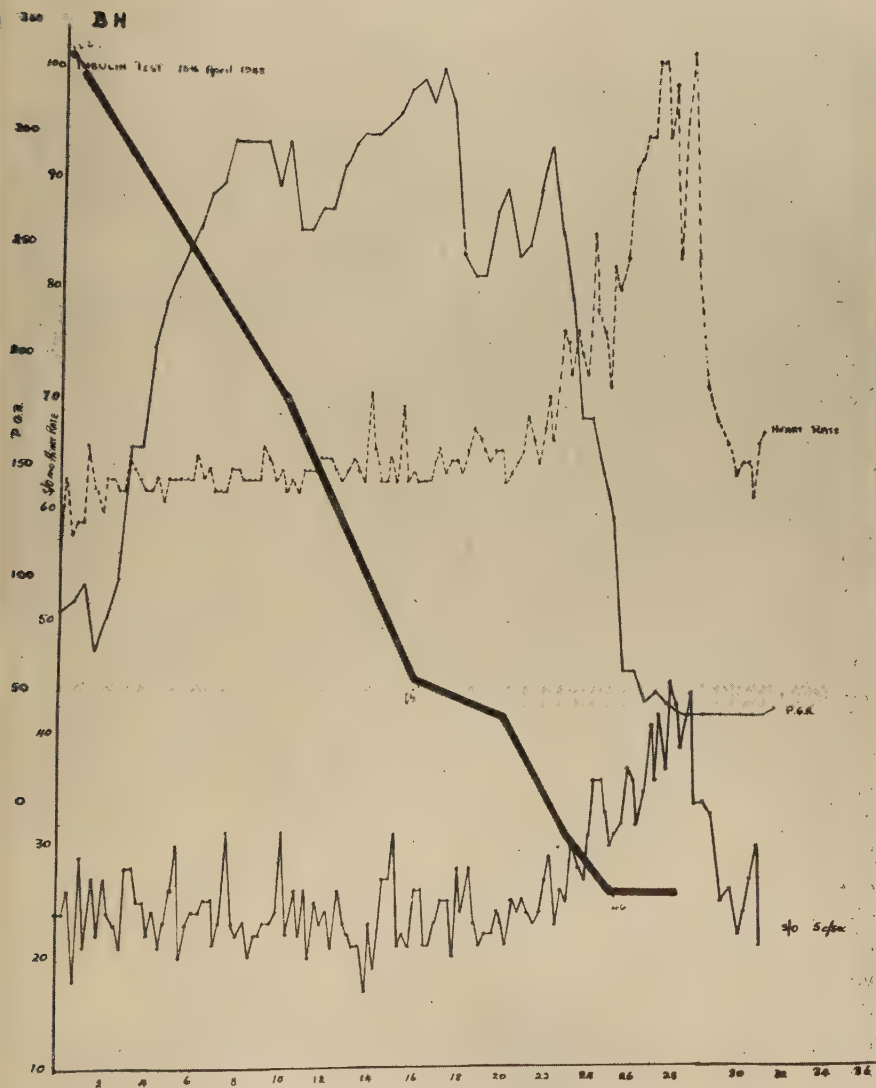


FIG. 12.—Same subject as in Figs 10 and 11, an experiment performed two months after that of Fig. 11. Mental state normal. Theta rhythm increased at 22 minutes is immediately followed by fall in G.S.R. and rise in H.R. The blood-sugar level fall is arrested at 25 minutes, the level being 46 mgm. per cent. This is a normal response, and contrasts with the two preceding experiments.

(2) The time at which this occurs after the insulin injection is significantly later in the schizophrenics (Fig. 6).

(3) The order of events—slow activity (theta rhythm) appearing at the cortex, fall in G.S.R. and rise in H.R., rise in blood-sugar level—is not general among the schizophrenics. In 29 out of 79 experiments, a rise in blood-sugar level occurred before the change in either E.E.G. or G.S.R.—a phenomenon not encountered among controls.

(4) The relationship between the time of rise of blood-sugar level on the one hand, and the time of appearance of theta rhythm and the time of fall in G.S.R. on the other, during initial insulin hypoglycaemia is a variable both between schizophrenic patients and for the individual patient, if the experiment is made repeatedly during the course of illness.

(5) But in the great majority of subjects, both normal (12 of 14) and schizophrenic (29 of 37 experiments), the appearance of theta rhythm anticipated the sympathetic-adrenalin discharge.

(6) A relationship is found between an absence of response in the E.E.G., G.S.R. and H.R. to a falling blood-sugar and catatonic stupor.

Figs. 7-12 illustrate the variability from a normal response to a gross failure of response which is encountered in catatonic stupor. During the period of recovery from psychosis the autonomic activity during hypoglycaemia shows great lability and reactivity.

DISCUSSION.

It must be emphasized that we have only examined one of the main adjustment mechanisms to hypoglycaemia. A fall in body temperature, which regularly occurs in normal subjects, and which results in lowered oxygen requirements of the brain, is an equally important homeostatic mechanism, but we have not examined this. However, within the limited scope of these experiments, it is seen that the adjustment mechanisms to hypoglycaemia are defective among schizophrenics and in a number of ways, but the differences are all a matter of degree. In general the findings are in agreement with those of other workers who have shown a delayed or inefficient response to stresses in these patients. The claim of the present work is that in addition to demonstrating again the known reduced excitability of the sympathetic-adrenalin system, the results throw some light upon the normal mechanism of the mass discharge of this system in so far as it is under cortical control. It is, of course, known that removal of the cerebral hemispheres does not affect the blood-sugar level, but the excitability of the autonomic centres, including those responsible for adrenalin secretion, is increased. It may be assumed that removal of cortical inhibition increases the excitability of both the sympathetic adrenalin and the vago-insulin systems (Gellhorn, 1943).

Since in 41 out of 51 of the present experiments the appearance of theta rhythm in the E.E.G. anticipated the sympathetic adrenalin discharge, this change in the electrical activity of the cortex may well be the sign of reduced cortical restraint on the activity of lower autonomic centres. In favour of this is firstly that hypoglycaemia depresses the functions of the cortex with its greater oxygen requirements before the deeper structures, and secondly, that

the centres for autonomic inhibition lie in the forebrain where theta rhythm appears.

The constant relationship between the appearance of cortical theta rhythm and the subsequent sympathetic-adrenalin discharge in controls may, if the above explanation is accepted, be regarded as evidence of the normal homeostatic mechanism to hypoglycaemia. In many experiments in schizophrenics, however, the falling blood sugar was halted before theta rhythm or the sympathetic-adrenalin discharge occurred. This again points to the cortical change, which is *late*, as the operative and determining factor, without which the sympathetic-adrenalin discharge is not released. In catatonic cases for example, despite a falling blood sugar to very low values, no change occurs in the E.E.G., the G.S.R., or heart rate. Nevertheless, in the just mentioned non-catatonic patients, a halt to the progressive fall in blood sugar was apparent, without the evidence of a general sympathetic-adrenalin discharge. In these instances, which were occasionally found among schizophrenics, a local discharge from spinal sympathetic centres must be postulated, or some other as yet unknown mechanism by which glucose is liberated from the liver.

In summary the data suggest four conclusions :

1. The depression of cortical functions in hypoglycaemia evidenced by the theta rhythm of the E.E.G. is delayed in schizophrenics.
2. The excitability of the central sympathetic-adrenalin system is less under these conditions.
3. The integration of functions in which the progressive depression of cortical function is followed by discharge of the increasingly excitable sympathetic system is defective.
4. These variations in excitability and functional organization bear a relation to the clinical state of the patient, and are most apparent in catatonic stupor.

We acknowledge with gratitude the technical assistance of Mr. F. A. Ibbott with the blood-sugar estimations, and the readiness with which doctors working at the Maudsley Hospital volunteered for the control experiments.

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COMMENTS ON THE OPENING PAPERS ON INDICATIONS FOR SHOCK TREATMENT

to be presented at the

INTERNATIONAL CONGRESS OF PSYCHIATRY

in

PARIS, SEPTEMBER, 1950.*

Insulin Coma Therapy of Schizophrenia : Some Critical Remarks on Dr. Sakel's Report.

By W. MAYER-GROSS, M.D.,
Crichton Royal, Dumfries.

FROM Dr. Sakel's address there emerge two questions regarding the indications for insulin treatment in the psychoses which are worth discussing on this occasion :

(1) General indications for the treatment : Should every case of schizophrenia undergo insulin therapy, i.e., be admitted to a hospital as soon as the illness has been diagnosed ?

(2) Special indications and procedure : What is the role of convulsions in insulin therapy ? What proof is there of the presumed antagonism between coma and convulsion ? Are there any facts supporting the idea that insulin fixes the results of convulsion therapy ?

In spite of Dr. Sakel's assertions and the favourable results reported by critical observers all over the world, insulin coma therapy still seems in need of justification, over fifteen years after it was first described. Sakel mentions some well-known reasons for this, but omits one important argument : even if applied expertly in cases within the first year of illness 40 to 45 per cent. of schizophrenics do not respond to this therapy. Authors who claim success in 80 per cent. and over of cases cannot have followed their patients for any lengthy period after the treatment. In view of this considerable proportion of failures, it seems unjustified to speak of the treatment as " specific " or " ideal " for schizophrenia. It has not been shown that insulin therapy carried on beyond the usual effective time (8-10 weeks with about 50-60 comas) gives improved results. My own experience is the same as that of R. Gjessing, who extended the experiment over years, viz., that refractory cases are not influenced by excessive prolongation of the treatment period. Impressions

* Read at the Spring Meeting of the Royal Medico-Psychological Association held at St. Andrew's Hospital, Northampton, on 13 July, 1950.

to the contrary may be based on the occasional event of a late spontaneous remission.

That Sakel's method does nothing but hasten remissions in patients who would remit spontaneously, and therefore is hardly worth the expense and trouble is the essence of the objections of M. Bleuler and G. Langfeldt, two careful workers who are opposed to its application. Bleuler includes a great proportion of spontaneously remitting cases among his material of non-treated schizophrenics; such cases would be diagnosed by others as affective psychoses. When he compares the results of insulin therapy with those in his untreated group he finds that the increase of remissions after insulin treatment is insignificant, even though the period of acute illness may be shortened. Similarly, Langfeldt introduces a concept of schizophrenia which differs from that used by most psychiatrists. He recognizes as schizophrenic only those patients who show certain basic symptoms, such as thought-disorder and affective blunting. Their progressive deterioration is, he thinks, not prevented by insulin therapy. The cases responding to this therapy are said to be "schizophreniform" psychoses, which have a different aetiology and a better outcome even when untreated.

The arguments of both workers are weakened by the fact that each has a stake in new classifications of schizophrenia; Bleuler would extend and Langfeldt would narrow the diagnosis. Most other workers agree with Max Mueller, who states that in patients whose illness has lasted not longer than one year the number of remissions can be doubled. This is substantially confirmed in a recent follow-up study of 454 schizophrenics treated at Crichton Royal between 1939 and 1947. This study also showed that the treatment may be worth while in some cases with an illness lasting for two years, but that in cases of longer duration the results are no better than in untreated material.

Table Showing Percentage of Recoveries after 3 Years.

C.R.I. Insulin-treated			Un-treated controls.
A	B	C	
Ill under 1 year.	Ill 1-2 years.	Ill over 2 years.	Ill under 1 year.
56.9%	43.4%	22.5%	34.5%

Insulin therapy neither provokes nor prevents relapses. The remissions after insulin therapy are neither shorter nor longer, the relapse rate remains the same and the tendency to relapse is not increased. If the patient relapses, second and third insulin treatments are worth trying and are successful in a certain proportion of cases.

One must, therefore, fully agree with Max Mueller and the others who stipulate that every early schizophrenic should be given the chance of insulin treatment. Convulsive therapy cannot, in our experience, equal its results as to completeness and permanency of recovery; this undoubtedly also holds true where convulsions are given, as advocated by Professor Ibor, in the favourable home surroundings of Spanish family life.

Because of the costly and complicated technique and the dependence of

*Table Showing Times of Relapse of C.R.I. Insulin treated Patients
Compared with Control Group.*

				Percentage of relapses amongst those discharged.	
Time of relapse.				C.R.I.	Controls.
Under 1 year from discharge	.	.	.	22·6	22·3
Over 1	„	„	.	7·9	4·5
„ 2	„	„	.	4·1	2·5
„ 3	„	„	.	2·3	1·6
„ 4	„	„	.	2·1	0·6
„ 5	„	„	.	1·8	—

results on expert supervision, insulin treatment centres should not be too small, and they cannot be improvised for occasional use. It is not worth while establishing a unit in hospitals where the yearly admission rate is below 500 patients. This implies some centralization of units within each region of the National Health Service.

While insulin coma therapy is superior to all other available treatments of schizophrenia, its limited successes do not entitle us to rest. It cannot be the last word of scientific medicine confronted with such a severe and malignant disease. It deserves intensive study and further development as exemplified in the research work of Gellhorn and Denis Hill.

Dr. Sakel's rejection of convulsive therapy in early cases seems legitimate enough if delay of insulin treatment is to be prevented; the danger is much greater if psychotherapy is advised. His general opposition to convulsions, and especially to their electrical induction is less rational and is difficult to reconcile with his recommendation for their use in certain variants of schizophrenia.

His detailed recommendations for combined treatment in certain clinical pictures, and for avoidance of convulsions in others, are difficult to follow. One source of difficulty is the variability of schizophrenic symptoms in the single case; a paranoid picture may easily change into a catatonic picture while the treatment is in progress. Similarly, simple and hebephrenic schizophrenia may develop into an "active stupor," or other catatonic and paranoid features may appear. Moreover, spontaneous hypoglycaemic convulsions may occur in any patient undergoing hypoglycaemic treatment. These spontaneous fits do not differ from those induced by metrazol or electricity, either in their symptoms or in the frequently favourable effect on the course of the patient's illness. Coma and convulsions can both also lead to a transient deterioration of the patient's behaviour. Psychotic symptoms of the more acute type can flare up; they usually subside if one persists with the treatment, and the succeeding remission seems all the better for this acute outbreak.

On the other hand, fits are not indispensable to the success of insulin therapy; of 202 patients who have remitted without relapse to date (9 years' follow-up), 64 cases had neither hypoglycaemic nor induced convulsions.

The following *indications* have proved useful rules to follow in the daily practice of insulin therapy :

Convulsions should be used in insulin therapy :

(a) Preparative—to achieve the co-operation of resistive, negativistic, restless, excited, and stuporose patients, and of those who refuse food or eat inadequately.

(b) Provocative—to induce a coma in patients in whom progressive doses of insulin and correspondingly low blood-glucose levels do not produce the expected cerebral reaction of coma. One or two convulsions given in hypoglycaemia are usually effective on the following day without increasing the insulin dose.

(c) For combating affective admixtures of the schizophrenic clinical picture: depression, listlessness, drowsiness, general moodiness, manic features.

(d) For speeding up recovery in those patients who, after initial improvement, remain on the same level for 3-4 weeks without further progress. A series of electrically induced convulsions, six in all, given on alternative days in coma frequently brings about a further improvement which remains stable after the convulsions have been discontinued.

This scheme of indications covers most of Sakel's specialized modifications, although nobody in charge of chronic schizophrenics will share his fear that convulsions hasten deterioration and dementia. On the contrary, "maintenance treatment" by E.C.T., spaced according to the individual requirements of the patients has become one of the indispensable symptomatic helps in procuring adaptation to a more satisfactory and happy life inside and outside hospital.

Convulsion and coma are both reactions of the human cortex to hypoglycaemia—one acute, the other subacute. While the former may be understood as a preformed defence mechanism in an emergency (Cerletti), the latter results from the withdrawal of the only fuel on which the brain can function, viz., glucose. Under which conditions the one or the other occurs in hypoglycaemia, seems to depend on the time factor of this withdrawal. Electro-physiological studies on the nature of seizures in general will probably soon provide a more satisfactory answer to this problem.

The idea of antagonism between convulsion and coma has, therefore, little scientific meaning. The same holds true of the phrase that coma is able to fix the results of convulsion therapy. These are modes of speech, comfortable speculations for the special restricted purpose, but they can hardly rank as hypotheses of heuristic value.

Discussion on Indications for Shock Therapy.

By WILLIAM SARGANT, F.R.C.P.,

St. Thomas's and Belmont Hospitals, London.

TO-DAY I want to confine most of my remarks on the indications for shock therapy to problems concerned with the proper selection and handling of patients for E.C.T. I intend to make only passing reference to insulin.

I feel that the position in regard to insulin has not really altered very much in the last ten years. Those of us using it then had already learned that, despite its limitations, it was a far superior treatment to convulsion therapy for schizophrenia, and that the earlier it was given—preferably in the first few weeks or months of illness—the better were the expected results. All that has happened since is that this impression has been confirmed again and again, and, though we are still a long way from finding a really satisfactory answer to the treatment of schizophrenia, certainly there is no better treatment available at present for the recent case. If given early it also leaves time for proper consideration of leucotomy, which should be done *after* the failure of insulin and E.C.T., in the first two years of illness if possible. So superior do the results of insulin appear compared to E.C.T. or electronarcosis, that I think those doctors who still substitute these treatments routinely for insulin in early recoverable schizophrenia must more than ever realize they are doing a very serious thing from the patient's point of view. Nor is there really convincing evidence as yet that modified insulin can be an effective substitute for deep coma.

While I have little to add to what I said about the selective indications for insulin at a meeting of the Royal Medico-Psychological Association in 1947, I would like to make the plea again that I first made in 1941—namely, that when hospitals have no facilities for insulin, suitable patients should be transferred to hospitals that have, or, alternatively, that special regional treatment centres must be established, as was done by the Emergency Medical Service for the treatment of an equally terrible mental disorder—general paralysis of the insane—during the recent war. My clinical experiences of insulin treatment in the past thirteen years have confirmed what statistics also now bring home to us every day more forcibly, namely, the tragic suffering that has been caused to so many hundreds of patients—many of whom have now become hopelessly chronic—through lack of such provisions.

Turning to the indications for E.C.T., the situation is more confused in some minds. This form of shock therapy has proved so successful in certain mental illnesses and is so easily carried out, and applied to all and sundry, that the same clinical mistakes are being made by some of its advocates as are being made by the too enthusiastic advocates of psycho-analysis or Christian Science—namely, that in greater or smaller doses it can be hopefully applied to all sorts and types of illness with prospects of some sort of success. At the same time a blind eye is being too conveniently turned to all the misery and abject terror that this weapon produces when treatment is given to the wrong patient, or at the wrong time in the illness, or in the wrong doses, or erroneously repeated when there is no evidence of success in previous treatments, nor any evidence that the conditions for expecting success have materially changed. In recent correspondence in the *British Medical Journal* we have had a psychiatrist feeling that there is little harm in long repeated courses on patients admitted to mental hospitals, but no specific indications were given as to those who are to be selected for this terrifying practice, as though this were not the most important point of all if any public discussion of such a formidable suggestion is undertaken.

My remarks will mostly concern those patients able to be treated with E.C.T. as out-patients, in neurosis centres, or in beds in general hospitals, but this group overlaps those treated in mental hospitals to a very considerable extent at the present time because of the tendency of some mental hospital superintendents, who may also control all the general hospital out-patient psychiatric treatment clinics for a wide area, to insist on such patients going into mental hospitals for this treatment. Many of these patients can, however, have the E.C.T. given as out-patients in these general hospital clinics with many advantages to all concerned.

If I am dogmatic in some of my indications for E.C.T., it is because it has been my good fortune to have been able to run an out-patient E.C.T. department for nine years now—first at St. George's Hospital and, since 1942, at the West End Hospital for Nervous Diseases. Fifteen thousand patients have also been through the wards of Sutton Emergency Hospital (Belmont Hospital) in the last ten years, which provided opportunities of using E.C.T. in a very wide and varied selection of different types of patient, from recent neurosis to acute and chronic psychoses. A year in the U.S.A. in 1947 and 1948 gave me the opportunity to compare results and practice over there with our own, and since taking up my present post at St. Thomas's Hospital I have been able to compare out-patient treatment done previously in the more usual set courses with a more conservative treatment of the same patients in subsequent relapses.

In my opinion there is one unquestionable indication for E.C.T. and that is in the treatment of certain states of depression, and such depressions must have certain symptoms present if success in treatment is to be anticipated. Patients should get to sleep fairly easily, but wake up early; and they should improve somewhat in their depression as the day progresses, though they may feel worse again towards bedtime. Where patients with depression show the opposite rhythm, getting to sleep with difficulty but not waking for the rest of the night, when sleep is not disturbed by the illness, or when the patient feels worse in the afternoon than in the early morning, the results with E.C.T. are much less certain, and it may well make the patient much worse rather than better. Older patients generally do better than younger ones with E.C.T., and "involutional" depressions without paranoid or hysterical features do best of all—provided they have the daily rhythm of mood disturbance already stressed.

In the depressed phase of the manic-depressive psychoses and in periodic depressions with a known rhythm of illness, the timing of the treatment is also of quite vital importance. To give treatment too early in the attack is often to waste treatment and to inflict unnecessary additional suffering, especially if long courses are used at this time. The patient often does not improve or relapses quickly, needing perhaps another short course nearer to the time of expected spontaneous remission. I wish I had time, for instance, to detail the patients I have seen who, having responded to E.C.T. at a later stage of an attack of depression, are then promised relief by psychiatrists if they will come again early in a subsequent attack. This has not then happened, and the patient despairs of further treatment when offered later at a time when it is likely to be effective. Patients have also been sent to me for opinion on the

desirability of leucotomy when all they have really needed was one or two more E.C.T.'s given later in the course of a depressive episode following failure of a first course earlier in an attack.

Turning to some other suggested indications: in America I found opinions on the treatment of manic patients as divided as they are in this country, with a growing feeling that manic attacks are often perpetuated as well as shortened by the unwise use of E.C.T. In schizophrenia, E.C.T. should usually be only adjuvant to insulin, and then best given in light coma or sopor when expected remission is hanging fire, or depressive or stuporose features are prominent in the total picture. Long courses of E.C.T. as a substitute for insulin in schizophrenia have so far found no statistical or clinical justification, and are generally advocated by those who have had little personal experience of working in an insulin coma unit and, therefore, of themselves using both methods.

Although I have not used the heroic courses advocated by some workers, I have never seen good results from E.C.T. in anxiety states, obsessional neurosis or hysteria, unless there was a depressive component, and even then results are not comparable to those achieved in the retarded depressions. It is, however, a tragic everyday experience to meet with the survivors of ordinary and intensive treatment of neuroses with E.C.T. who have had yet further symptoms added to their previous disabilities. These may take the form of memory defects, depersonalization, increased anxiety, or greatly increased general emotional lability. Among my follow-up patients I have had those who have subsequently recovered with leucotomy, but who still complained bitterly of persisting memory upsets from prior long courses of E.C.T. often given and continued with no real indication that they were ever likely to be of help.

No survey of E.C.T. and its indications can be considered complete without a further reference to the manner in which it should be given. This weapon, capable of bringing so much mental peace or frenzied terror to the patient, is often being handled at the present time like a recipe for cooking—the same ingredients to be put in every dish served up. As the main indication for E.C.T. is the treatment of retarded depressions, let us also not forget that often these depressions clear up spontaneously with time. All we may have to do is to get the remission under way and coax it along gently with suitable spaced treatments. At the West End Hospital, involutional depressives have been found to clear up with as few as four fits, given at weekly intervals, and even with less than this. On admission to some hospitals, this same type of patient may be given three fits a week and up to ten fits in a course, and then also need another fortnight or more to get over the severe memory changes induced so unnecessarily. These remarks do not apply to the very severely agitated depressions, but I often wonder whether many of the usual run of depressives do not take about a month to remit with E.C.T., and the number of fits considered necessary may often depend on the number per week the doctor chooses to apply. I do know that patients often have far more fits than they really need, and if only doctors are not too desirous of always pressing the button twice or thrice a week, and are content to use E.C.T. to help along the patient's natural tendency to remission in sparing doses, much misery can be avoided.

We have found the giving of one E.C.T. a week for two weeks a good practice to adopt in out-patients whose anticipated response to E.C.T. is uncertain. Also the relatives are asked to observe the patient's response to each fit. If the patient is somewhat better for 24-48 hours after each fit and then relapses, one can carry on with treatment. If, however, the patient feels worse and seems worse for 24-48 hours after a fit, but is then better again for the rest of the week, the doctor has to be very careful that he is not mistakenly treating an anxiety state with reactive depression, and so running the risk of making the patient's condition even worse if he proceeds with a full course of E.C.T. We have found this over some years now to be a most useful therapeutic test taken in conjunction with other clinical indications.

Lastly, I would deprecate the school of thought which feels that intensive E.C.T. can replace leucotomy or has any of the major beneficial effects of this operation. E.C.T. is predominantly the treatment of depression and mental retardation, and leucotomy of chronic anxiety and obsessional tension. E.C.T. often flares up conditions relieved by leucotomy, while leucotomy can precipitate such disasters as attacks of mania in patients with recurrent endogenous depressive psychoses who have had the operation instead of properly spaced E.C.T. in their attacks. While there is some overlap in patients with mixed pictures, the time has surely come when we should try to distinguish with greater certainty the respective indications for E.C.T. and leucotomy, which are generally so different, and not go from one to the other on a crude conveyor belt system of treatment.

If E.C.T. is used sparingly, selectively and cautiously, it is still one of the most valuable treatment weapons we possess. If it continues to be tried as a treatment for all types of patients who do not happen to respond to simple psychotherapy—by no means an uncommon attitude to-day—then less total suffering might result from its abolition than its continued employment in the future in routine psychiatric practice.

Intensive E.C.T.

By E. STENGEL, M.D.

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IN trying to contribute to this symposium one can either comment, in the light of one's own experience, on what the principal speakers say about indications in general, or one can pick out a special problem which requires clarification. I have chosen the latter course. I propose to report on some observations on the effect of "intensive E.C.T." By this I mean the administration of two to four shocks on successive days over a period of a week or two, which aims at producing a confusional state with deep clouding of consciousness. It is the method that has been advocated in this country by Milligan. Cerletti devotes a section of his report to this method. According to him, it was Bini who first employed it. He noted that it resulted in a temporary and almost complete annihilation of mental life. Cerletti calls it annihilation therapy, *l'anéantissement*. Nobody who has carried out or witnessed this treatment will deny the aptness of the term. American writers have called it

regressive E.C.T. Bini and Milligan have reported very satisfactory and lasting results in chronic neurotics who had failed to respond to other therapies. It has been claimed that it saved quite a number of patients from leucotomy. In view of these claims it is surprising how little we have heard of this powerful treatment since the first reports appeared. It may therefore be of interest to present some observations made at Graylingwell Hospital in a small group of patients treated with this method. I hope that those among you who have used it will tell us about *your* experiences. The group consisted of ten psychoneurotic patients. Except for two, who were obsessional, they were suffering from long-standing hysterical symptoms with or without anxiety. They were treated in 1947 and early in 1948 and followed up for periods of one to three years. Compared with the results published by others, ours were disappointing. None of the patients became symptom free. In only three could one speak of a marked improvement, while in the rest the symptoms either remained unchanged or became worse. This group is, of course, too small to allow of generalizations regarding the therapeutic value of the method. I should, however, like to mention a case of a middle-aged man with a severe old-standing anxiety neurosis, who, following intensive E.C.T. at the Crichton Royal, deteriorated rapidly, developed paranoid ideas and had to be certified. Intensive E.C.T. has some interesting side effects. It has been likened to leucotomy, but I did not observe permanent personality changes similar to those following leucotomy. The patients who failed to improve continued to complain about their symptoms with the same emotional intensity as before. They showed, however, features, during and after treatment, reminiscent of those associated with a severe and diffuse head injury. There was profound clouding of consciousness, and all mental activities were blotted out between the shocks; there was invariably retrograde amnesia (RA) and the equivalent of post-traumatic amnesia (PA). In the majority of cases the RA, which was at first very extensive, shrank gradually, but in none of the patients was it reduced to a period of less than two days. Even a year or more after treatment, recall for events which had taken place several months before treatment remained patchy. In four of the cases the RA was much more extensive. In the first of these four cases it extended over several years, and only very slowly, within about a year did it shrink to a period of several months. In the second case the solid RA was, within a year, reduced to a period of several weeks, but the memory for events which had occurred over several years preceding treatment remained patchy. In the third case, a chronic anxiety state with hysterical and depressive features, the RA extended over four months and cleared up gradually only within a year. The amnesia was a source of great distress to the patient as it had blotted out certain events which meant a great deal to him. The condition for which he had been treated had not improved.

In the fourth case, a middle-aged hysterical woman, the RA was even more severe. She had forgotten not only the events of her whole previous life, but also much that she had learned from childhood. Everything seemed new to her. She enquired about the significance and the names of familiar objects like a child of three. She had forgotten her parents, her husband and her illness. Unfortunately her symptoms soon reappeared. The patient who was treated

in 1947 is still in hospital unimproved, her RA having shrunk to a period of three years. This patient, like the others, has had a good deal of psychotherapy. Hypnosis and narcoanalysis have also been employed in her case.

In all cases the equivalent of a PA could be demonstrated. As you know, the duration of the PA following head injury is a measure of the severity of the injury (Symonds and Russell). The duration of the PA could be established in five cases treated with intensive E.C.T. It extended over periods of four days to about two weeks. PA of similar duration has been recorded after severe head injury. In none of the cases did the amnesia following treatment show a tendency to undue extension, and its duration can be regarded as being in accordance with the severe traumatic interference with brain functions such as this method produces.

Six of the ten patients could be tested adequately by the late Dr. Brody who used the R.M.P.A. battery of tests, which he had himself introduced in collaboration with Dr. Hutton and others. In only one case, the third of the four cases with extensive RA, were signs of intellectual impairment similar to those which follow brain injury discovered, and they were not quite specific. None of the patients showed the clinical features of the organic amnesic syndrome, apart from amnesia.

The most outstanding side effect of the treatment was, therefore, a massive RA, exceeding anything that has been observed after ordinary E.C.T. and anything that has been reported after intensive E.C.T. RA following ordinary E.C.T. is, of course, well known. It has been studied by Flescher, Mayer-Gross and others. Mayer-Gross remarked on its resemblance to the RA following head injury. As a rule it is not a symptom of practical importance and in E.C.T. it rarely extends over more than one minute. It is not surprising that after intensive E.C.T. it should extend over much longer periods. It may be argued that a permanent RA of even a few days, or a week or two, though indicative of a severe and prolonged cerebral trauma, would not in itself be disturbing, especially if not accompanied by other lasting signs of cerebral damage. However, the four cases I mentioned were incapacitated the patients to varying degrees. They were all hysterics and there can be no doubt that the prolonged RA was of the type of a severe hysterical symptom which had formed round an "organic nucleus." It was due to a mechanism often observed after head injuries. Obviously, the unconscious availed itself avidly of the disability produced by the treatment. Here we have an impressive example of what has been called organic compliance. None of the patients had previously had periods of hysterical amnesia. The RA was in these cases not an artefact produced by repeated testing. Care was taken not to arouse undue interest in the examination, and in two of the four patients the symptom was discovered many months after the conclusion of the treatment. Retentive memory and learning were unimpaired. Even in the hysterical patients therefore the basic pattern of the memory disorder was of the "organic" type following head injury.

It is interesting that massive RA extending over long periods has not been observed following ordinary E.C.T., not even in hysterical patients, although complaints of general memory impairment are, of course, not uncommon.

My observations suggest that in treating hysterical patients by the annihilation treatment of Bini and Milligan we are taking the risk of producing a new symptom which it may be difficult to remove. I therefore regard it as contraindicated in such cases. Considering the frequency of hysterical features in all neurotic conditions, the scope of this method in the treatment of psychoneurotics seems very limited. Possibly intensive E.C.T. has a place in certain chronic schizophrenic states, but my experience with it in that type of patient is too small to allow me to express an opinion.

Indications for Shock Therapy.

By E. C. DAX, B.Sc., M.B.,

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It is time the term "shock therapy" was dropped. Its meaning is not clear, we constantly attempt to avoid shock to our patients, it is not always therapy and the term does not do us much good in the eyes of our colleagues or the public.

The various forms of treatment usually referred to in this way will be considered in turn. The attitude towards convulsions has had to change. The effect of insulin comas has been attributed to the convulsions which may occur, but precautions are now taken to avoid the fits. Electrical convulsion therapy is just as effective when the muscular contractions are eliminated with curare; convulsions are avoided in prolonged narcosis though the results have been attributed to an induced epileptic state. We have shown that section of the lower portions of the frontal lobes in leucotomy operations is in many cases more effective than the upper incisions, though by this means the subsequent convulsions are practically eliminated.

There is much to be said for examining the role of consciousness in the effects of these treatments and the part played by the diencephalon in psychiatric disturbances. Too great an importance has been paid to the motor rather than to the receptor side in association with its affective relations, and we have, I believe, much to learn from the study of the effects of the various physical treatments approached from this angle. The epileptic manifestations may be simply the end products of a more fundamental diencephalic disturbance from which the therapeutic effects are obtained.

In retrospect it may well be shown that the so-called shock therapies have passed their day and that we are beginning to embark upon a new era of applied pharmacology which is growing with added understanding from the advancement of these empirical treatments. It is, however, still unpredictable as to whether the use of drugs exerting their actions on one or other portion of the nervous system will be as effective as other means of stimulating the brain centres to the production of biochemical changes within the body.

Arising from such considerations as these the distinctions between electrical convulsive therapy and leptazol (metrazol, cardiazol) become of interest. We have generally used leptazol in preference to electrical convulsive therapy

in feeding difficulties, stupor, in depressions associated with marked delusions, and in cases with much psychomotor activity, as in mania and certain varieties of schizophrenia. The distinction between leptazol and E.C.T. was supposed to be one of fear, but this has been disproved, whilst the period of delay between the injection and fit, which also has been held responsible, can be practically eliminated by using a higher dosage of leptazol than is usual. There are certain other differences; for instance, that with leptazol there are less memory defects, tuberculous lesions are more easily reactivated, there are some differences in the variety and strength of the fit, and that in consequence more fractures occur, whilst various sedatives have different actions on the form of the induced fits or their threshold.

In general there is now a fair agreement in the use of the physical forms of treatment. E.C.T. relieves the symptom of depression in most varieties of illness, though its most striking effect is probably seen in the cases of involutional depression where the prognosis has been completely changed; for instance, it has been said that approximately twice as many of these patients now recover in about a quarter of the previous time. In the simple schizophrenics with apathy, most people, I think, prefer at least to start treatment with a longish course of convulsion therapy. It is of interest that all these conditions, for which E.C.T. is usually given, react well to the orbital incisions of selective leucotomy. Convulsion therapy is also widely used in states of psychomotor activity either in mania or catatonia excitement. Some would prefer to use leptazol in these cases; others, multiple electrically induced convulsions. In catatonic excitement convulsion therapy can usefully be combined with insulin comas. In the agitated depressions there is much to be said for giving electrical convulsions in the waking hours of a preliminary prolonged narcosis, and a similar procedure is often useful in those patients who become restless and noisy in their waking hours. Multiple electrically induced convulsions have also been reported to be of use in breaking up neurotic reactions resistant to other forms of treatment, although the confusion and memory loss may be severe.

Insulin coma treatment is still the method of initial choice in most cases of schizophrenia, but few hospitals have the facilities for using this therapy on any but the earlier cases, and in any case convulsion therapy may be preferred in such instances. In this country insulin comas often seem to be used with convulsion therapy in catatonia and preceded by E.C.T. in simple schizophrenia. There have been some advances in recent years in the additional means of approach used in conjunction with the comas. The comas are but a part of a course of treatment, which involves attention to every portion of the patient's life during the period of treatment. In this light the psychological approach, individually, in groups or through the arts, now appears to fill a more important place than was previously the case.

There has been no reliable evidence to suggest that the subjection of the early schizophrenic in the out-patient department to either E.C.T. or electro-narcosis has anything to recommend it over insulin coma therapy. It would still appear that a case needing insulin should be fully treated, but that the results of such treatment are possibly to accelerate the discharge of patients

with illnesses from which in any case they might eventually attain a remission. However, the degree of recovery seems to be better than before insulin was used. I think there is a point here which has constantly to be kept in mind. As more is known to the public about psychiatric illness and its treatment and further out-patient clinics are opened, patients seek admission earlier than before, and in many cases we may see schizophrenic reactions associated with adolescent instability. A proportion of these were successfully dealt with by general practitioners in the past and perhaps a fair allowance should be made for this factor in our assessment of the patients and the results of treatment.

We gave up using electronarcosis some months ago after a fairly extensive trial, without success, in cases which had failed to improve after being adequately treated with deep insulin and convulsion therapy. I have not used acetylcholine; triazol and ammonium chloride have been given up, although I am inclined to believe that a further trial of ammonium chloride might be warranted. Lastly we still use prolonged narcosis with sodium amytal and paraldehyde by the mouth. We have treated twelve or thirteen hundred cases, mostly for periods of three weeks, by this means, and still feel that it is of the greatest use in cases of psychomotor hyperactivity, those who are non-co-operative in treatment and some with neurotic reactions, and that it lays a satisfactory foundation for the other forms of treatment and thereby enhances their usefulness.

A Note on the Indications for Shock Therapy.

By T. P. REES, M.D., M.R.C.P.,

Warlingham Park Hospital.

OUR present state of knowledge concerning the changes brought about by shock therapy is such that the application of these forms of treatment is still largely empirical. This is due to the fact that we are not aware of the mode of action of these different modes of treatment and also because the classification of the various forms of mental disorders is still very unsatisfactory. This is particularly true when we are dealing with that heterogeneous group of mental illnesses lumped together as schizophrenia. Many cases of so-called schizophrenia will recover without and even in spite of shock therapy, and I very much doubt whether the concept schizophrenia has done anything to help us in choosing our cases. A diagnosis to have any value should give us (a) a clinical picture of the patient, (b) an indication of the course of the illness which would be helpful in giving a prognosis, and (c) some guidance as to the appropriate treatment for a particular patient. Most clinical psychiatrists will agree that the diagnostic label schizophrenia fails us in all these respects. I read with great interest in the booklet of the International Congress Dr. Meduna's article in which he divides schizophrenia into two groups (a) endogenous schizophrenia, and (b) symptomatic schizophrenia. He points out that shock therapy is of value only in cases of symptomatic schizophrenia, which is more or less identical with the confusional insanity and the exhaustion psychoses of the English Board of Control classification of mental diseases. He goes

further and shows that there are biochemical differences which can be administered between the two groups. I feel this observation, if confirmed by other workers, will prove invaluable in enabling us to prescribe the appropriate treatment.

In my own hospital I find that the best results in shock therapy are to be obtained by giving E.C.T. in the affective disorders of the psychotic type, particularly in involutional melancholia, including the late involutional melancholias occurring between the ages of 65 and 80 which are often erroneously diagnosed as senile dementia. Favourable results from E.C.T. may also be obtained in—

- (a) Catatonic type of schizophrenia.
- (b) Epileptic instability, including epileptic furor.
- (c) Unmanageable behaviour in chronic psychotics.
- (d) Reactive depression, particularly in elderly people.
- (e) Paraphrenia, particularly where there is a marked affective component.
- (f) Psychoneurotic depression, if inaccessible to psychotherapeutic approaches, but on the whole the psychoneurotics do not respond well to E.C.T.

Insulin therapy is of value in the psychoses of the non-affective type :

- (a) Schizophrenia, particularly hebephrenia and paranoid schizophrenia, and in the catatonic type combined with E.C.T.
- (b) Schizoid depressive states and paraphrenia.
- (c) Schizoid personalities. In our experience very young schizophrenics do not respond well to insulin treatment.

Leucotomy should not be used until other methods of treatment have failed. It is successful in schizophrenia (but is of no value in the hebephrenic type), paraphrenic, manic depressive psychoses and chronic psychoneurotics, particularly obsessional neurotics, where psychotherapy has proved unsuccessful.

I agree with Dr. Mayer-Gross in deploring Sakel's attitude. I think that E.C.T. has a place in the treatment of neurotics in mental hospitals. They are of a rather different type from the neurotics one sees in out-patient departments, and E.C.T. has the effect of making them more co-operative and thus facilitates other forms of treatment. I have used E.C.T. in epilepsy, and found it most useful in cases of epileptic furor. It also has a definite use as a symptomatic treatment ; there are many chronic patients who are more settled and better controlled if given occasional E.C.T.

As for schizophrenia I think that the term has little meaning ; it often signifies no more than that the patient is mad ; it carries no clinical picture, no prognosis, and no clear indication for treatment. It must be recognized that many schizophrenics are incurable by any means so far known. Meduna believes that these were the true endogenous cases ; there were also symptomatic forms and in his biochemical studies he had discovered differences in sugar metabolism between the two forms.

Discussion.

THE PRESIDENT (Dr. J. Iverson Russell) said that the papers so far read had already shown some difference of opinion. They must all strive to develop accuracy of diagnosis and judgment in selecting cases for treatment. As Dr. Sargant had said, the temptation was to put every patient through the whole battery of treatments.

Dr. HENRY WILSON supported Dr. Sargant in his observations on depressives. He agreed that patients who had difficulty in going off to sleep were not likely to benefit from E.C.T. His impression was that these enquiries were not made often enough; the questions, however, had to be put with care. It was best to ask the patient—"Don't you feel better in the morning than in the evening?" A negative reply could then be taken as reliable. He would also like to give a warning concerning patients whose depression was associated with physical causes—in these cases one should go carefully. Depressives in late life responded well, and he had seen cases improve after treatment at the age of 75 or over.

He would stress the importance of a follow-up after three months and again after nine months. No clear picture of the final result could be obtained at the time of improvement. Especially in depressed cases with suicidal ideas one should be cautious, and one should give the patient at least two weeks' observation before undertaking E.C.T.

He would also like to refer to cases of cyclothymic psychopathy, with exacerbations of depression; in such cases there was a temptation to give E.C.T. Often, however, the exacerbation was reactive or due to exogenous factors, and recovery occurred rapidly without any treatment.

Dr. ACKNER said that he had no doubt that insulin *treatment* benefited schizophrenics. He had purposely stressed the word "treatment." The benefit might well be due, not so much to the insulin, as to the setting in which the treatment was given. Patients undergoing it were generally in a special insulin unit; they were part of a group and the treatment was perhaps a form of group therapy. He suggested a control experiment in which a number of patients were treated under exactly the same conditions, but were given intravenous barbiturate instead of insulin. It would be difficult to arrange, but would be well worth doing.

Dr. YOUNG referred to what had been said of physical contra-indications to E.C.T. He thought that the use of the new drug—Decamethonium Iodide or C 10 should have been mentioned; with this, no one was unfit to have E.C.T. unless absolutely moribund. He was certain that there was a group of depressives in the late 70's or early 80's who could still be salvaged. He suggested that, in using intensive E.C.T., the complications mentioned by Dr. Stengel might perhaps be avoided if they were given adequate oxygen during treatment so that all cyanosis was avoided.

Dr. WEIL spoke on the relation between insulin coma and convulsions. He was always pleased if fits occurred about the 5th or 6th coma, and he never attempted to stop them.

Dr. JONES said that he had studied his own E.C.T. registers and he realized that he had been treating a very mixed lot of patients. He asked himself why the treatment had proved so useful. He thought that in all those patients there had been a failure of repression, and in consequence reality was altered for them in a way of which they were aware. In depression they remained, so to speak, "below the line"; in mania they battled with the alteration in reality and so remained "above it." In reactive depressions symptoms arose from different levels of personality and it would be found that the deeper the level, the better the response to E.C.T. Similar considerations applied to schizophrenics, and in order to assess the probable value of E.C.T. one should always analyse the symptoms in relation to personality levels and alterations of reality.

Dr. COOK said that he could not agree with Milligan as to the value of E.C.T. in neurotics. In his opinion no neurotic benefited for any length of time, and in these cases E.C.T. should be reserved for acute emergencies only. On such occasions it might be better to give 12-15 convulsions spread over three days than to use the heavy sedation which was the only alternative. Like Dr. Stengel he had seen massive amnesia of hysterical type after such treatment. For the rest he agreed with the views expressed by Dr. Sargant.

ETHER: AN ESTIMATION OF ITS USE IN THE TREATMENT OF THE PSYCHONEUROSES.

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SHORVON and Sargent (1947) have given a full account of the history and development of the use of ether in relation to excitatory abreaction. They have shown how valuable its use can be to rid patients of emotional tension which has occurred as a result of some particular battle experience, such as being blown up, buried alive, torpedoed, etc. They propound various theories as to the mechanism of excitatory abreaction, and they give a full description of the technique they employed, illustrated by examples from the numerous cases with which they dealt.

The object of the present paper is to show that ether also has its place in the treatment of ordinary psycho-neurotic illness, not dependent on specific external experience, such as a battle trauma, but arising from the everyday difficulties and psychological maladjustments with which we all have to deal in our psychiatric practice.

It so happened that shortly after the publication of Shorvon and Sargent's article the present writer came across one or two cases still suffering quite acutely as a result of war experiences, and he was able to produce satisfactory abreactions according to the technique described in that article. Owing, however, to the prolonged interval that had elapsed between the precipitating experience and its reactivation under ether, with the consequent well-established neurotic pattern that had been developed, complete relief of symptoms was not, in every case, so easily obtained, and much patient psychotherapy was subsequently required.

So much easing of the patient's disabilities was obtained, however, that the idea was developed of using ether in ordinary cases of psychoneuroses that came to the Clinic. It was felt that if ether could uncover specific suppressed experiences and release the emotional tension attached to these experiences, it might also be able to uncover other repressed psychological traumata and so aid in the process of psychological readjustment.

It was decided, therefore, to try ether in a series of cases as they presented themselves to the Clinic for treatment. In the early days of this research it was entirely a case of trial and error, as technique had to be modified, and one had little idea as to the type of case that would be likely to respond. Further, any dangers and pitfalls were as yet unknown.

It was realized from the outset, however, that in many cases it would be

impossible, and in some cases undesirable, to obtain an actual abreaction. The object was simply so to loosen the patient's highest inhibitions that he or she would be able to give expression to the thoughts and fears underlying the illness—thoughts and fears which otherwise might be expressed only after weeks and months of patient psycho-therapy or analysis. In other words, I felt that if, by using ether, I could materially reduce the period of treatment, the result would be well worth while.

It is true that I had already a considerable experience of barbiturate narco-analysis, both as regards in-patients and out-patients, but I was never particularly happy in its use, and especially did not like it with out-patients. The giving of an intravenous injection is so final ; once the barbiturate is in the blood-stream it cannot be removed, and has been known to produce toxic symptoms some considerable time after its injection. The use of ether, on the other hand, appeared particularly attractive from the out-patient point of view, as there were no foreseeable difficulties.

TECHNIQUE.

The cases I have dealt with have all been out-patients, many of whom were carrying on with their work, although under considerable strain and disability. I found from experience that it did not matter what time of the day treatment was given, and this could easily be arranged to suit the patient's work. The only precaution necessary to take, from the patient's point of view, is that he should not have anything to eat for three hours prior to treatment, and only a comparatively light meal then. Of all the cases I have treated, over 30 in number, only one has complained of not feeling well afterwards, and in this case there was a special reason for it. In no case was the ether directly responsible for any symptoms, either immediately or during the rest of the day after treatment. It is not necessary to ask that a relative or friend accompany the patient in order to see him home, as a short rest after the treatment is finished is all that is required.

As regards the administration of the ether, the open mask method with a covering to protect the eyes is the one of choice. The patient is taken fully into one's confidence, and a full explanation of what is going to be done is given. I have found that many patients are afraid that they are going to be put to sleep, and it is essential to reassure them on this point.

I have found, contrary to the technique described by Shorvon *et al.*, that a comparatively slow induction is advisable when one is not out to obtain a full excitatory abreaction. Considerable skill is required, and is acquired only by experience, in judging the depth to which the patient should be taken, and it may be necessary to vary this during the course of a single treatment. I have found from experience also that some patients will talk better and more freely if they are put fairly deeply under and then allowed to come out. It is as if, while going under, the patient's conscious control holds on till the last possible moment, and will not allow the underlying thoughts and emotions to find expression. While the patient is coming out of the "ether state," however, consciousness is not able to take control again so quickly and the patient is

thus freed to talk. It is again a matter of experience and judgment to know how far out one should allow the patient to come.

If one does induce quickly in the types of cases I have dealt with in my series, one only succeeds in setting up a resistance. On the other hand, of course, induction must not be too slow, or the patient may sink into a comfortable stupor and not talk at all, although, if this happens, it may be possible to get him going on lightening the degree of etherization. By adopting the method described, I have been able to reproduce classical attacks of anxiety when the "sensitive spot" has been touched, either by some direction from me or during the course of the patient's own talk.

In the majority of cases it is not necessary to have anyone else in the room. Indeed, in many cases it is undesirable, for the patient retains, however dimly, sensitiveness to his external surroundings, and the presence of some third person acts as a brake to full co-operation on the part of the patient. Occasionally it happens that a very nervous patient—particularly a female—feels easier if a nurse is present. On rare occasions, also, it has happened that a patient has gone unexpectedly into a true excitatory abreactive state, and to guard against this I have arranged to give a special signal should I need immediate assistance to control a patient.

The problem of how to get adequate notes about the proceedings has been solved in various ways. Least satisfactory, for the reason given above, is the presence of a stenographer to take down everything in shorthand. This may, in addition, lead to a great waste of time, as much of what is said may be irrelevant.

To overcome this difficulty I devised a contrivance on the principle of an adjustable lamp. The main support is fastened to the side of the bed or couch, and the projecting arm is freely movable and can be placed at any distance from the patient's face. This arm carries the mask, which can be lowered to or raised from the patient's face at will. Should the patient show signs of becoming restless, the arm can easily be pushed right out of the way. Otherwise the doctor is left quite free for note-taking, apart from the application of the ether as required.

A third method which has proved of great value in certain cases is to record the whole proceedings on a wire-recorder. Wires which will run up to one hour are obtainable, so that a complete session can be recorded on one wire without any break. I always obtain the patient's permission if I wish to record, as I feel, quixotically perhaps, that it is taking an unfair advantage of the patient otherwise. I have never yet been refused permission.

The value of this method is two-fold. Either a written verbatim report of selected portions of the session can be obtained at leisure, or alternatively, permanent recordings on disc records can similarly be made of selected passages. The second advantage is that if, during the session, something is said by the patient which is not quite clear, either as to meaning or significance, the appropriate passage can be played over and over again on the wire-recorder until one is quite satisfied as to what actually did occur during the session. This is no theoretical point, but a very practical one. The writer and a colleague were working together on rather an unusual case, and it was surprising how

frequently a discussion arose as to the meaning of a certain passage, or the sequence of some events described by the patient. A playing back of the scene on the recorder invariably settled the point, and agreement was always reached.

The disadvantage of the wire-recording method is that it is extremely time-consuming, and involves the co-operation of several workers if it is to be done properly, especially as regards the subsequent recording on discs.

CASE MATERIAL.

I have tried out the foregoing methods of ether analysis on many cases now, with varying degrees of success. I have had quite a number of failures—cases in which etherization did not help at all in the process of uncovering the nature of the trouble. Some of these may well have been due to inexperience and faulty technique; others were due to the fact that the cause of the trouble was so deep-seated that even under ether the patient could bring no fresh light to bear on the problem. On the other hand, I have learned to be very careful in using ether on this type of case, as the following example will show.

CASE 1.—D. R—, male, single, aged 24, attended the Clinic first on 16.xi.48. He first began to complain of symptoms three years previously while he was studying hard for the higher national engineering certificate. Just prior to the examination, he became what he described as "hysterical," but he got through. From then on he had felt in a constant state of tension and anxiety, which became more pronounced if he went to the pictures or a party, etc. About Easter, 1948, he began to worry about his bowels. He became constipated, and thought this was due to appendicitis. He stated that later he developed a swelling on the right side, but his doctor could find nothing wrong. Patient worried in case he had obstruction or other serious abdominal trouble. He had a severe anxiety attack while taking his parents for a motor drive at the beginning of October, and at this time he began to feel that things seemed unreal. Ten days before attending the Clinic he had another severe anxiety attack in which he felt as if he were dying. He had a choking sensation and could not get his breath, and he felt as if everything had stopped functioning. He felt dreadful and in a state of acute panic. The unreality feelings persisted and were subjective, i.e., he felt different himself in normal surroundings. Time relationships were also distorted in his mind, e.g., a few minutes after his leaving home it would seem to him like hours.

He had always had a fear of injuries and operations, particularly the latter. He was rather quiet and reserved in nature, but had some good friends. Three years previously he had a girl friend, but she married an American and went overseas with him. His mother was a very nervous, excitable type; father in good health; patient an only child.

Patient had a marked fear of insanity, and it was felt advisable to treat him, if possible, as an out-patient.

He was given ether on 19.xi.1948 at the second interview.

At first he talked on general topics, then stated his mind had gone blank. Presently he became acutely distressed and went through a typical anxiety attack. When this passed he again said his mind was a blank, then "That's funny; a word comes into my mind, I don't know why—sex." He then described some schoolboy practices he had indulged in with his friends, and went on, "That reminds me of something that happened earlier, with a little girl, my cousin. It was when we were in bed together, but I was too little to know what I was doing." "Do you still know your cousin?" "Oh yes, she is married now, to an American sailor." "Really, so it was your cousin who married an American sailor?" "Oh no; why do you ask me that? It was my girl friend who married an American sailor."

The general pattern of the development of his anxiety state had thus become clear at one ether session, but unfortunately it was too much for the patient, who became so ill that he had to be admitted to hospital on 30.xi.1948. His somatic

symptoms shifted from his bowels to his genitalia—it was painfully obvious why—and he developed marked ideas of reference, with severe agitation. He was treated with prolonged narcosis, and was only beginning to settle down when he left hospital against advice before he was ready for further psycho-therapy.

This case, occurring early in my series, was a very sharp lesson on the danger of the indiscriminate use of ether, and I never now give it till I have seen the patient several times, and have been able to satisfy myself there is no foreseeable risk of material coming out before the patient is ready to accept it.

The following cases, however, show the other side of the picture, namely, how ether can be of great assistance in the treatment of different types of nervous illness.

Case 2, one of anxiety neurosis, shows typically how ether may be used with effect during the treatment of the case.

CASE 2.—M. H—, female, single, aged 34, first attended the Clinic on 16. viii. 1948 with the history that symptoms had begun about Christmas, 1947. These consisted of severe head pains, anxiety and depression, with a good deal of weeping.

These symptoms had started while she was in a convent in London, training to be a nun, and they began not long before she was due to take her final vows. Her symptoms were so severe and persistent that she had to give up studying and leave the Convent. When she came to the Clinic her symptoms had improved somewhat, but the question to be determined was, should she resume her intended career as a nun. This she was most anxious to do. She had been fully investigated physically, and was satisfied she was healthy in this respect. She was most willing to co-operate in a psychological investigation.

On her third visit on 24. ix. 1948 she was given 5 per cent. Cyclonal intravenously. Her veins were very thin-walled, and began to bulge after 3 c.c. had been given, so the injection was stopped. The following information was obtained : The patient was the second youngest of five sisters in a Roman Catholic family. Her father died when she was 18 months old. They were not a very religious family, and patient was not a practising Catholic. She was for 12 years a shorthand typist in the office of a manufacturing firm and was very happy in her work. She was a reserved type of girl and did not have many friends. She was very fond of children and would have liked a large family of her own. She knew only one boy well enough to go out with occasionally, but the war affected him and he began to swear and drink. The patient is very bigoted on the subject of alcohol.

In 1941 when she was 27, she was persuaded to take some "instruction," and from then on her interest in religion deepened until, in 1947, she entered the convent herself.

On 30. ix. 1948 she was given 9 c.c. 5 per cent. Cyclonal intravenously, but little more information was obtained, although I got the impression she felt that the Church was not omniscient in its teaching, and I thought this a possible source of conflict.

She was subsequently interviewed on October 8 and 19, but she could give no further information that was helpful, except that she wondered if the fact that just after she left school she saw her grandfather's dead body in his coffin could have any bearing on her trouble, as this had rather worried and upset her at the time. It was decided then to use ether.

25. x. 1948 : Ether analysis. Patient fought for a considerable time against "going under," but eventually she did. She showed a good deal of tension and agitation, and she addressed Our Lord, saying, "Oh, I do so love You and want to come to You." Then she complained bitterly about her head and feared she would not be able to learn her Catechism. Later, at the end of the session, she stated she felt that Our Lord did not want her as she was not good enough.

At the next visit on 8. xi. 1948, ether analysis was repeated. She almost at once became very agitated and distressed, spoke about being frightened, and said she had once felt that fear before when asked to see her dead grandfather. There was a pause, and then she said, "Oh, that awful night." For a time she resisted telling what had happened, and even said she had forgotten.

Then she said that on this night she seemed to have been asleep for some time, and woke to see a man standing by her bedside in her cell at the convent. She could feel his hands on her face and by her side "but there was no one there." Then she could feel him on top of her and he was trying to have what she thought was relations with her. She told the Mother Superior about it, who said not to worry, but it was shortly after that she took ill. Session stopped.

22.xi.1948. Patient interviewed on conscious level. She talked much more freely and admitted she had "forgotten" this vision, although now she could recall it clearly. It was obviously a vivid sex dream, as a result of which she now admitted she had an orgasm. She did not recognize the figure of anyone she knew, but the face of the man was "horrible." In view of the fact that he succeeded in his purpose, the symbolic significance of this is considerable. She then told me of a dream she had the night following this experience, and this was of Our Lord and his Mother who were both weeping. She also admitted to anxiety over masturbation, which had occurred not infrequently in recent years.

The whole meaning of her illness was now clear, and it remained to get her to realize what had occurred, and to adjust herself to the fact that she could never return to the Convent and take her vows. This was successfully done, and by February, 1949, she was bright, cheerful and happy, and had resumed work in an office. She was seen at rare intervals for a further year, and was finally discharged from the Clinic in March, 1950. Between August, 1948, and February, 1949, when she resumed work, she attended the Clinic on twelve occasions only.

Case 3 also an anxiety state illustrates how ether can be of value in quite an unexpected way, apart from its use in helping to unravel a problem.

CASE 3.—A. B—, female, single, aged 27, first attended on 26.x.1948. She was complaining of typical anxiety symptoms, being nervous, tense and on edge all the time, had severe head pains, and a feeling of exhaustion. This had been going on for about four years. She felt depressed, and unable to cope with things as she should.

At the first interview she was definitely hostile and resentful in her attitude, and it was difficult to get information from her. She did admit to being unhappy at home, particularly as regards her mother. She was happy in her work as an accounts clerk, and in addition she was studying speech and drama in which she was sitting various examinations.

At the second interview, on 6.xi.1948, she was equally resentful and little further information was obtained, except that she had had a man friend for the past three years and she was thinking of getting married. He was 50 years old, and the only happiness she knew was in his company.

Her attitude was such that I felt it would either take weeks to break down her reserve as a preliminary to adequate investigation and therapy, or else she would default and be lost sight of. I decided therefore to proceed immediately with ether.

18.xi.1948: Ether analysis. At first there was a recapitulation of her home worries and troubles, and, while still talking of this she slipped in the information that she had had a baby. Details about this and her love for her child's father (he was a married man) followed, and she admitted she realized he was a rotter and cared for no one but himself. She had not seen her baby for five years now as it was adopted, but she still yearned for it. As she was coming round patient wept very bitterly.

Two sessions of ordinary psychotherapy followed, and by 11.xii.1948 patient was feeling very much better and could see her whole position in its true perspective. On 5.iv.1949 she wrote to the clinic reporting that she was quite well and happy.

The point about this case, apart from the economy of interviews and speed of recovery, is that ether completely broke down the reserve and hostility which the patient first showed. After the ether she was very frank and friendly, and her difficulties could be freely and easily discussed.

The next case shows the value of ether in a very different type of condition, namely, a hysterical fugue.

CASE 4.—D. W—, male, married, aged 29, was seen by me in a general hospital on 27.x.1948, where he had been admitted following a fugue which had lasted for three days and nights. By the time I saw him he had remembered who he was, but had no idea at all where he had been during the three previous days.

On 28.x.1948 he attended the clinic and was given ether. The technique used in this case was to induce him comparatively deeply and then direct his thoughts to the events immediately prior to the time he "disappeared." The fugue began while he was on his way to work in the evening (he was on night-shift at the time), and under the ether he began to describe leaving home and getting on to the bus to take him to work. Without any pause or hesitation he proceeded straight into the fugue state and described in exact detail everything that he did, until he partially came to himself and realized that he was "lost."

From this description he went on to talk about himself and the troubles he had had, which were of many years' standing. He had never really known his mother, who developed a psychosis as a result of the birth of his younger brother when patient was only 18 months old.

Patient was always highly strung and nervous. He had a severe attack of chorea as a boy, just after going to see his mother, who did not know him. One of his grandmother's favourite remarks about him was that he was useless and getting like his mother. More recently patient had learned that his mother was an epileptic. Patient said that he had a terrible temper when it was roused.

He had felt greatly perturbed since the birth of his own boy, 3½ years previously. His two worries were: (1) that he himself would become like his mother, and (2) that his boy would become like him.

Patient and his wife had rows at times over the upbringing of the boy. On the morning of the same day on which the fugue occurred they had had such a row before he went off to bed.

On 8.xi.1948 all the above information was discussed at the conscious level and explanation given of reason for fugue. Patient stated he was feeling easier in his mind than he had done for many years.

26.xi.1948: Interviewed again. Patient well and happy. Stated he felt as if a great weight had been lifted from him, and his wife had remarked on how well he was compared with what he had been ever since she had known him.

The point about this case is that not only was the memory recovered of what had occurred during the fugue with the greatest of ease, but, what is much more important, he was able, under the ether, to reveal what lay behind it. In this way readjustment with the minimum of psycho-therapy was possible, and in fact he was seen only four times, including the preliminary interview in the general hospital.

The following case was of quite a different type to those already described, and the use of ether was entirely experimental. The patient was a psychopath of essentially the inferior type, although with strong aggressive tendencies.

CASE 5.—L. R. B—, male, single, aged 28. He first attended the clinic on 18.ix.1948, and he complained of a general lack of confidence with a severe inferiority complex. If anyone started an argument with him, a surge of fear would pass through him and he did not know what to say. He felt so inferior he could not get on with anyone at all.

He had been like this for as long as he could remember, but only in recent years had he felt so worried about it that he decided to seek help. He was nearly 30 and still single. He tried to make friends with girls, but they would have nothing to do with him as he became so flustered and started stammering. He felt inferior to both sexes, but more so with women than men.

One brother ten years older, also with a strong inferiority feeling, which he relieved through drinking. Patient owned a house equally with this brother,

who did not live in it but would not sell his share. Patient lived alone in this house apart from two lodgers in the front rooms.

He was in the Army for five years and did not get on well, as he could not mix with the others. Before joining up he lived in the same house, but father was alive then. Mother died in 1936.

Patient did not get on with his parents for as long as he could remember, and he had a most unhappy childhood. Mother wanted daughters, and when the sons arrived, she was very unkind to them. She dominated both patient and his brother. The father was a strict disciplinarian, but did show a little more affection than the mother. Patient hated his parents, particularly his mother, and never really knew what it was to be loved by anyone. He felt sometimes that people passing in the street talked about him. He felt humiliated, tense and worried because of his inferiority feelings, and he sometimes felt aggressive towards people, and would willingly have struck them, although he had never actually done this.

It appeared to me that ordinary psycho-therapeutic measures would be of little value in this case, as it was of such long standing, even if he could accept an explanation of his feelings and attitude on an intellectual basis, so I decided to give him ether and see what happened.

30.ix.1948 : Etherization : Patient started talking very shortly after treatment was begun and needed no prompting from me. The reaction was violent, although not an abreaction in the true sense of that word, and he shouted and raved, giving full rein to all his pent-up feelings. It concerned essentially his youth, the attitude of his parents, and his own feelings towards them. Although he was extremely tense, his aggression was verbal and he did not become physically violent.

14.x.1948 : Patient reported that for five days after the treatment he had felt wonderfully improved, and then the old feelings of inferiority and aggressiveness returned. He was given another treatment with ether and again he became violent and vindictive in his remarks.

20.x.1948 : A third treatment with the same result.

11.xi.1948 : Ordinary interview. He admitted he was feeling very much better, and when he was asked in what way the treatment had helped him, he replied that it had definitely released the feelings of tension and aggression. He now felt much more contented and not nearly so inclined to be ruffled, and he also felt more able to tackle his major problems.

When seen again on 20.xii.1948 he was bright, laughing and cheerful. He had managed to make friends with a girl and had even taken her out. His own estimate was that his feelings of self-consciousness and inferiority had disappeared by about 50 per cent.

By May, 1949, he was not so well again and wrote asking if he could have further treatment. When seen on 23.v.1949 he was again tense and the inferiority feelings had returned to a marked degree. The love affair had petered out.

2.vi.1949 : Etherization. A further very violent reaction, directed essentially against his parents. He was not seen again until 25.vii.1949, when he was once more feeling much better, and talked more freely and with more vigour.

No more ether was given, and he was seen at ordinary interviews on a further three occasions, the last being on 3.x.1949. He was still feeling reasonably improved, and did not have the same urge to come and see me. He felt he could carry on by himself, and by May, 1950, he had not contacted me again.

It cannot be claimed that this man was cured. It is extremely doubtful if any treatment could ever cure him ; his inferiority feelings were so deeply ingrained and of such long standing, but at least life has been made reasonably tolerable for him, and I feel that I could not have achieved this result without the use of ether.

DISCUSSION.

It has long been an accepted axiom of psycho-therapeutic treatment that an intellectual acceptance by the patient of an explanation of his illness will not produce a cure. The patient must "feel" that the explanation is true before he will obtain relief from his symptoms.

This principle applies whether the cause of the trouble is superficial and conscious or is so deeply placed as to be quite unconscious, and it is a matter of judgment on the part of the therapist in each individual case as to how he is going to bring about this flash of understanding and emotional acceptance of the cause and nature of the trouble in order to produce the desired effect.

I would like to suggest the theory that it is in regard to this very point that ether can be particularly valuable as an aid in psycho-therapy, given the right type of case.

In all the cases I have dealt with successfully, the patient, under ether, has linked for himself, or herself, the symptoms with the cause, or part of the cause. In the cases I have described the patients invariably talked at first in relation to these symptoms and how they felt, and then, without any prompting from me, they either described what was really troubling them, or at least gave me some hint as to what the trouble was, and tactful questioning could produce the full story. In other words, what is really the most difficult aspect of psycho-therapy, namely, getting the patient to accept emotionally, as well as intellectually, the relationship between the cause and the nervous illness, is already partly accomplished. The patient's mind is prepared to accept the psychological explanations because he has already linked the two himself, although he may not be fully consciously aware that he has done so.

It seems to me, therefore, that ether aids in the treatment of the psychoneuroses in two ways. Firstly, in a general way, it enables the patient to bring into consciousness material that has been repressed, or strongly suppressed, and secondly, in some more specific way, it helps to establish the link in the patient's mind between the nervous symptoms and that material. It may be argued that there is in reality no distinction between these two ways, and that if the patient succeeds at all in revealing what is worrying him, then the link between the repressed material and the symptoms is automatically established. With this point of view I do not agree, and my experience with ether analysis strengthens my convictions in this matter. For some reason, however, under ether the patient does effect, wholly or partially, this all-important link, probably entirely on an emotional basis, and that is why acceptance of the explanation given by the therapist at the later interviews is the more easily obtained, and also why this acceptance is the more certain to be successful in producing the alleviation of the symptoms. It is for this reason that I believe ether to be a powerful therapeutic agent in the treatment of the neuroses.

It is for the very same reason, however, that ether is also potentially a dangerous weapon if used unwisely. In the first case described, exactly the same sequence of events occurred as in the others—a description of symptoms, with, in this case, an actual anxiety attack, and then, for no apparent reason,

so far as the patient was concerned, a description of an early sex trauma. The patient, however, was not ready to accept the link, as evidently still more deep-seated issues were involved, and so his condition was made worse rather than better. There is little doubt that, with experience, it is possible to recognize the cases in which it is too dangerous to use ether, and I have no doubt also that experience will teach the therapist the best way of dealing with such a situation should it arise.

I would like to suggest that, as a general principle, if a patient, during a first ether session, begins to talk of psychological traumata that have occurred during the first ten years of life, the session should either be broken off at once, or the patient gently brought back to some recent events and the session stopped on quite an innocuous note. The second alternative would appear to be the method of choice, as the patient's mind in this way could be calmed and the dangerous material safely "forgotten" again before the effect of the ether wore off. If, however, the session had to be suddenly stopped, there might be the danger of leaving the patient's mind in an uncertain unsettled state, although in a more vague way, than if the material became more fully conscious.

Apart from the foregoing, the advantages of ether over the intravenous barbiturates are numerous. It has been found that ether will "get at" trouble which ordinary narco-analysis has failed to elicit. This applies equally to in- or out-patients, but in the latter type particularly ether has the very great advantage that the patient recovers very quickly and there are no after-effects. This does away with the need for a relative to accompany the patient, and as it is often very difficult for a patient to arrange to be accompanied, arrangements for treatment are correspondingly simplified.

There are practically no contra-indications to the use of ether, apart from the psychological ones mentioned. The only one I have met has been in a case where the patient suffered from fairly severe chronic bronchitis. I did give him ether, but he complained afterwards of feeling unwell and nauseated, so that the treatment was discontinued. Otherwise no patients have complained, and none have refused a second or subsequent treatment if it has been felt advisable to give it. Indeed many patients who were apprehensive before the first treatment have expressed surprise at how comparatively pleasant the treatment was.

It is not claimed that ether analysis is a substitute either for ordinary psycho-therapy or for psychoanalysis. Indeed, there are many cases where only an orthodox analysis could hope to attain a cure or even an alleviation of symptoms, and in general these are the cases where ether either fails entirely to help in the uncovering of hidden traumata, or else it succeeds only too well, as has already been described.

What is claimed is that ether can be a very valuable aid during the course of ordinary psycho-therapy, and in different types of cases. By its use treatment may be reduced by many months and in the number of sessions required. From the individual patient's point of view this is of great economic and practical importance, and any method that shortens treatment and enables him to feel better more rapidly, provided the good result is as permanent as it

could ever hope to be, is definitely worth while. From the doctor's point of view he is able to treat more cases, and that, in these days of overcrowded clinics and hospitals, is also a matter of considerable practical importance.

It should be emphasized that in the types of cases I have dealt with, psychotherapy must be given after an ether session. It is sometimes wise to have an ordinary interview between each ether session if more than one is given, but in other cases two or even more ether sessions may be given, and then the matter discussed at ordinary interview. This is entirely a matter of judgment in each individual case, and no hard and fast rule can be laid down on this point.

CONCLUSIONS.

It would appear from the results obtained in my series of cases that the judicious use of "ether analysis" in association with ordinary psychotherapy will, in many cases, give results better than psychotherapy alone could do; that the number of interviews and the length of treatment can be materially shortened, to the great advantage of both patient and doctor; and that ether has very many advantages over the intravenous barbiturate method. The main disadvantage is that great care must be taken in the choice of patients who can safely be subjected to ether analysis, although this is a disadvantage that with experience tends to lessen. Occasionally a patient who could otherwise probably benefit, is not suitable on physical grounds for ether analysis, and ordinary methods have then to be tried.

SUMMARY.

The use of ether in the treatment of cases of ordinary neurosis is described.

Technique is discussed, and cases of various types of neuroses are described to illustrate the method of use.

The advantages and disadvantages of ether as an aid in psychological treatment are discussed.

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REFERENCE.

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PERSONALITY CHANGES FOLLOWING PREFRONTAL LEUCOTOMY AS REFLECTED BY THE MINNESOTA MULTIPHASIC PERSONALITY INVENTORY AND THE RESULTS OF PSYCHOMETRIC TESTING.

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THE object of this study is to investigate the extent to which the MMPI* reveals personality changes following prefrontal leucotomy, and how these compare with personality changes as shown in the results of intelligence testing.

Twenty-one cases have been investigated; 16 men and 5 women. Their ages range from 23 to 54; their average age is 37. All were in-patients in a mental hospital serving a large rural area, between the years 1946 and 1948. All have undergone the usual forms of physical treatment before leucotomy was resorted to.

The patients were unselected but for the fact that only those cases were used in which testing could completely be carried out before and after operation. This excluded those who were either too disturbed or too dull to complete all tests.

Patients classified according to their diagnosis.

- 9 schizophrenia.
- 3 hebephrenic schizophrenia.
- 1 paranoid schizophrenia.
- 1 paraphrenia.
- 1 obsessive compulsive state in schizoid personality.
- 1 depression with schizoid features in obsessional personality.
- 1 chronic obsessive compulsive state with conversion symptoms.
- 1 obsessive compulsive state.
- 2 manic-depressive psychosis.
- 1 anxiety hysteria.

* Its authors call the MMPI a "Psychometric instrument designed ultimately to provide in a single test, scores on all the more important phases of personality." The test consists of 550 statements printed on separate cards which are sorted by the patient into three categories: TRUE, FALSE and CANNOT SAY. The scorable items are tabulated on a basic record sheet used to score the different syndromes. The raw scores of a measured trait are translated into a standard score (the T-score), and plotted on a profile chart, the configuration of which is more important than the presence of any one trait to an abnormal degree.

Syndromes represented on Profile Chart:

Psychological Tests used before and after Operation.

Minnesota Multiphasic Personality Inventory.

Battery of intelligence tests (Stanford-Binet on 16, Wechsler on 5).

Kohs Blocks.

Raven's Progressive Matrices.

Corresponding series of the same tests have been used following operation as far as available.

Some of the patients spent a long time in hospital before operation was considered, and they have been tested at varying intervals before operation. Similarly, owing to the exigencies of the individual case, the length of the time between the operation and the date of retesting varied. In some cases retesting has taken place soon after operation when early discharge seemed advisable. In others recovery was slow and the patients had to settle down to a longer convalescence. In that case the date of retesting would be a later one.

Changes in the Minnesota Charts.

A comparison of the total number of T-scores on the different syndromes show an all-round decrease in the number of scores, causing a shifting of the chart towards the normal range. The decrease, though general, is unevenly distributed over the different syndromes.

*Chart I** based on average T-scores before and after operation.

The drop in scores was heaviest on the neurotic triad: Depression, hysteria and hypochondriasis; and on psychasthenia and schizophrenia. Psychopathic deviation, paranoia and the masculinity-femininity scale are more or less fixed points. Hypomania shows a slight tendency to increase.

In view of the small number of samples, statistical analysis has been carried out on all syndromes in order to test the validity of the changes. The "t" test of the significance of the difference between means, with the correction for small samples has been used:

$$t = \frac{M_1 - M_2}{\sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{N}}{N(N-1)}}}$$

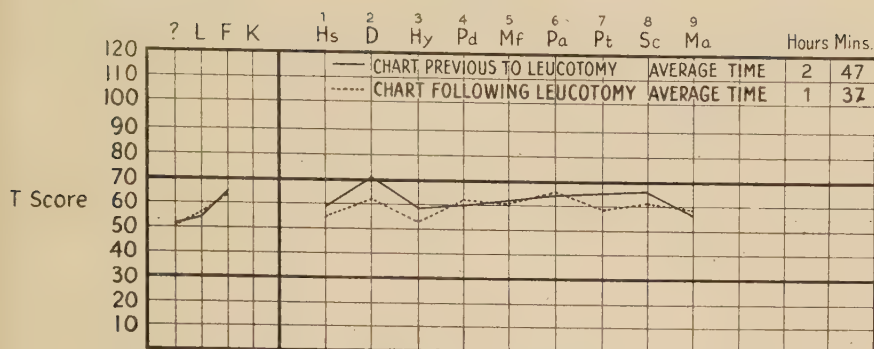
M_1 denotes the mean or average of all T-scores of the measured trait or syndrome before,
 M_2 the mean or average of the measured trait or syndrome after operation:
 d the deviation of the values of the samples after operation;
 N the number of samples; $N-1$ the Degree of Freedom.

Rapaport's* criteria were applied to evaluate the results.

"Any difference which was significant from 10 per cent. to 20 per cent. was considered to represent a MILD TREND toward a significant differentiation; any difference which was significant from 5 per cent. to 10 per cent. was considered a STRONG TREND approaching a significant differentiation; any difference which was significant from 2 per cent. to 5 per cent. was considered SIGNIFICANT; and any difference at or below the 1 per cent. level was considered HIGHLY SIGNIFICANT. Here the significant percentages refer to the number of chances in a hundred that the obtained differences were fortuitous results."

* D. Rapaport, *Diagnostic Psychological Testing*, Chicago, 1945, Vol. I, p. 33.

CHART I.



All charts are non K-corrected

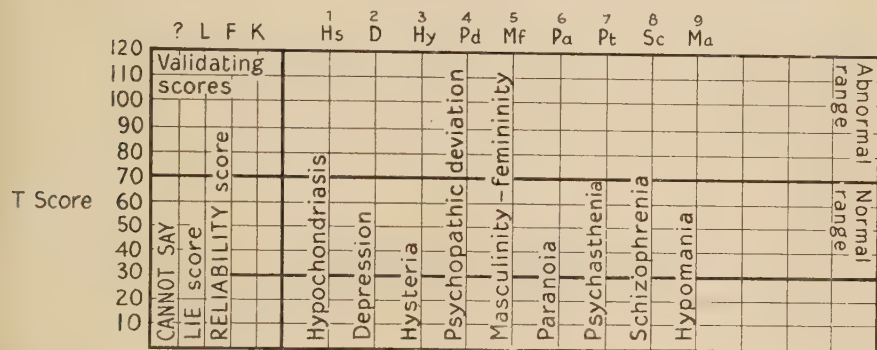


CHART II.

Syndrome.	Mean ₁ .	Mean ₂ .	" t. "	Level of significance.
Hypochondriasis	56.24	57.19	0.24	60-70%
Depression	70.57	62.43	2.47	2-5%
Hysteria	58.24	52.95	1.44	10-20%
Psychopathic deviation	60.38	60.52	0.051	<90%
Masculinity-femininity	61.95	60.62	0.45	60-70%
Paranoia	64.19	64.62	0.15	80-90%
Psychasthenia	64.86	57.71	2.52	2%
Schizophrenia	67.67	63.76	1.40	10-20%
Hypomania	56.48	59.57	0.89	30-40%

Validating scores :

Question	(?)	51.43	50.86	1.68	10-20%
Lie	(L)	56.24	57.19	0.42	60-70%
Reliability	(F)	66.48	64.67	0.69	40-50%

Time in minutes 167.67 97.24 4.42 >1%

Prognostic indications for the different syndromes are positive for psychasthenia and depression, the " t " score of both suggesting SIGNIFICANT decrease ; the " t " scores of hysteria and schizophrenia suggest a MILD TREND towards improvement.

Paranoia and psychopathy do not change to any significant degree, and in fact, do not show any tendency to either increase or decrease. This means that psychasthenia, depression, hysteria and schizophrenia, or the traits that constitute them, can be expected to improve, but psychopathy and paranoia are unlikely to do so. The post-leucotomy chart shows the syndromes with favourable prognosis shift towards the normal range, while psychopathic deviation and paranoia remain more or less fixed points; their prominence growing in proportion to the weakening of the others. Prognosis in severe cases of psychopathy and paranoia would therefore be unfavourable. (See Cases 7, 13, 16.)

Hypomania does show a tendency to increase after operation, but its "t" score is significant on the 30-40 per cent. level only, ruling out a reliable expectation of a definite change. This is worth noting in view of the fact that depression is likely to weaken considerably, or to disappear altogether. Consequently, in the case of manic-depressive psychosis, depression can be expected to clear up with a high degree of reliability, while hypomania would, if anything, increase. Thus with depression ceased, hypomania would become the dominant feature of the post-leucotomy personality, a development amply borne out by clinical observation and follow-up reports. (See Cases 6, 10, 19, 20.)

Of the validating scores, F-scores and Lie-scores do not show any appreciable change, but the "t" score of the question score suggests a MILD TREND of the CANNOT SAY items to decrease.

There is an enormous drop in the amount of time required to complete the test after operation. (Average time 2 hours 47 minutes before, and 1 hour 37 minutes after operation.)

Statistical analysis has also been applied to the different personality traits and attitudes. All statements referring to the same trait or attitude have been listed and "t" score based on means of the number of raw scores of the measured trait. It should be remembered that only items representing the infrequent (significant) answers score. Thus two seemingly contradictory statements score in the same direction, i.e. the statement "I have used alcohol moderately (or not at all)" scores if classed FALSE; and "I have used alcohol excessively," scores if classed TRUE.

CHART III.

Personality traits.	Number of statements.	"t."	Level of significance.
Anxieties, phobias .	30 .	2.01 .	5%
Hallucinations, delusions	15 .	3.33 .	>1%
Obsessions	14 .	0.64 .	50-60%
Mood	34 .	1.76 .	5-10%

Abnormal trends that changed to a significant degree were: Anxieties and phobias, delusions and hallucinations, and mood.

The SIGNIFICANT weakening of anxieties and phobias is one of the most generally recognized changes after leucotomy. The statements refer to a large

variety of anxieties, to fears of impending disaster of an unspecified nature, and to specified phobias relating to objects (fire, water, dark, lightning, spiders, snakes, mice, etc.) as well as situations (closed and open places, heights, crowds, etc.).

A group which weakens to a HIGHLY SIGNIFICANT degree comprises statements on feelings of unreality, day-dreaming, imaginary companions and auditory, visual and olfactory hallucinations. It is worth noting that the only one statement out of 15 showing an increase in scores was, "Peculiar odours come to me at times." This is possibly a physiological effect of the operation. The weakening of delusional and hallucinatory experiences, too, is one of the changes established and accepted by clinical practice.

A third group, showing a STRONG TREND to change was that concerning variations in the dynamics of the state of mind, commonly referred to as "mood."

The statements extend over a wide range : Broodiness, depression, inability to "get going," restlessness, excitement without adequate reason, over-activity, bursts of anger, sudden swings between extremes, etc. The main characteristic of the changes is the weakening of the violence of extremes in both directions ; a shifting towards indifference with a loss of tension. This again is an established fact in both literature and clinical practice.

The list of obsessions comprises statements on compulsive urges, such as to injure, to steal, to memorize or count irrelevant matter, to jump from high places, etc. According to the "t" score, obsessions do not change. They remain fixed points, and with other psychotic trends weakening, they become a dominant feature of the post-leucotomy personality of the obsessional, or the schizophrenic with marked obsessional characteristics. Four out of our 21 cases would bear this out. (Nos. 3, 4, 5, 11.)

This finding is in contradiction to reports in literature and the prevailing view of clinicians that obsession has a good prognosis. "Obsessions are removed," and "Notably without obsessions," states a recent survey of the "Effects of section or partial excision—Frontal Lobes," by A. Kennedy ("The relation of Brain to Mind," *The Advancement of Science*, Vol. VII, No. 25. 1950).

CHART IV.

Attitudes to	Number of statements.	" t."	Level of significance.
Religion . . .	14 .	0.30 .	70-80%
Sex . . .	30 .	0.86 .	40-50%
Morality . . .	25 .	1.53 .	10-20%
Family . . .	14 .	2.025 .	5-10%
Childhood . . .	20 .	2.36 .	2-5%
School . . .	7 .	2.24 .	5-10%

Changes in attitude to religion, sex, law and the accepted code of morality have been analysed. According to "t" scores there was no change in attitude to religion and sex, but there is a MILD TREND to increase of contempt and disregard of common decencies. The following list of statements will illustrate

best the decline of moral principles and social responsibilities that lead to the well-known lack of discretion and callousness of the post-leucotomy patient in conduct and consideration of others. ("t" score on MORALITY was based on the number of TRUE answers before and after operation.)

"A person shouldn't be punished for breaking a law that he thinks is unreasonable."

"It is all right to get around the law if you don't actually break it."

"It would be better if almost all laws were thrown away."

"I do not blame a person for taking advantage of someone who lays himself open to it."

"Most people are honest chiefly through fear of being caught."

"People generally demand more respect for their own rights than they are willing to allow for others."

"Most people inwardly dislike putting themselves out to help other people."

"I am against giving money to beggars."

"I think most people would lie to get ahead."

"I think nearly everyone would tell a lie to get out of trouble."

"Most people would use somewhat unfair means to gain profit or an advantage rather than to lose it."

"The man who provides temptation by leaving valuable property unprotected is about as much to blame for its theft as the one who steals it."

"If several people find themselves in trouble, the best thing for them to do is to agree upon a story and stick to it."

"I feel that it is certainly best to keep my mouth shut when I am in trouble."

"When I am cornered I tell that portion of the truth which is not likely to hurt me."

"I am always disgusted with the law if a criminal is freed through the arguments of a smart lawyer."

"Most people make friends because friends are likely to be useful to them."

"I think a great many people exaggerate their misfortunes in order to gain the sympathy and help of others."

"I frequently find it necessary to stand up for what I think is right."

"There are certain people whom I dislike so much that I am inwardly pleased when they are catching it for something they have done."

"I don't blame anyone for trying to grab everything he can get in this world."

"When someone does me a wrong I feel I should pay him back if I can, just for the principle of the thing."

"I would certainly enjoy beating a crook at his own game."

"I do not always tell the truth."

"If I could get into a movie without paying and be sure I was not seen, I would probably do it."

An item by item analysis before and after operation resulted in a clear-cut division of statements on family relationships in adulthood as distinct from family relationships in childhood, and of statements on childhood relating to home and relating to school.

Family in general is regarded with more sympathy and tolerance after operation. The statements refer to troubled family relationships such as quarrels, lack of sympathy and love, feelings of hatred and jealousy, etc. "t" score suggests a STRONG TREND to decrease after operation.

The same applies to the statements on school. They all refer to difficulties such as truancy, poor scholarship and bad behaviour. There is a STRONG TREND to deny difficulties at school after operation which were admitted before.

A spate of bitter resentment bursts forth on comparing statements referring to home and childhood before and after operation, shown in the increase of ratio in practically all items of a reproachful nature. This increase

is SIGNIFICANT according to "t." Parents disapproved of one's friends and interests; one was punished without cause and made to obey unreasonable commands. Twice the number admitted after operation that they wanted to leave home at one time.

Childish pursuits and interests that require secrecy, or are subject to adult disapproval, are more readily admitted after operation. Having been members of gangs and engaged in petty thievery, having sought excitement, played with dolls (in case of boys), and liked hopscotch, are a few examples.

This sudden revival of old resentments of some intensity, of parental authority in the post-leucotomy personality whose main characteristics are emotional detachment and generally a "Don't care" attitude to everything, points to an aspect, not so far stressed, in assessing personality changes after leucotomy. It seems as if *regression* on a large scale were taking place. If this is so, it would account for the weakening of the sense of responsibility, for making light of law and morality, and for that lack of forethought so often emphasized by writers on changes after leucotomy. Gross regression is a well-known phenomenon in severe and deteriorating psychotics. Regression as a general symptom of the severity suggested by the MMPI after leucotomy, would be of major significance for prognosis, re-education and after-care.

Of all the tests employed to detect personality changes after leucotomy, the MMPI proved the most sensitive. It helps to differentiate and to isolate personality traits and makes it possible to assess the changes quantitatively.

CHART V.

Test.	Mean ₁ .	Mean ₂ .	"t."	Level of significance.
Battery I.Q. . .	101.48	102.05	0.21	80-90%
Kohs I.Q. . .	85.43	89.42	1.77	5-10%
Matrices score . .	36.52	33.90	1.01	30-40%
Matrices time in minutes . .	42.71	21.81	3.02	>1%

Comparison of the results of intelligence tests before and after operation, confirmed the well-known fact that the intelligence quotient does not change to any marked degree.

The fact that there was no significant change in the I.Q. after operation, however, does not mean that there was no change in the performance. Analysis of results suggested several changes in both quality and quantity that seemed characteristic, but they are too subtle to obtain numerical significance.

There was no appreciable change in the extent or area of the scatter.

Scatters after operation give on the whole a similar picture to what one would find if a group of psychotics were retested after a course of E.C.T. or insulin. There is general improvement, but it is mainly restricted to tests in which failure before treatment was due to lack of attention and concentration, or to retardation. These handicaps tend to weaken or to disappear after treatment, and the patient regains to some measure his former speed and his ability to apply himself to certain tasks.

Memory tests were affected most. Improvement was greatest in tests requiring immediate memory, such as copying a design from memory (Memory for Design ; Copying a Bead Chain) and Repeating Digits Forward.

There was a slight tendency to improve in all types of tests requiring abstract thinking (observed also in Shipley-Hartford Abstract Thinking Test, the results of which are not included in this study). This fact, together with follow-up reports and numerous observations on post-leucotomy patients, would contradict the frequent assertion that impairment of abstract thinking ability is one of the significant effects of the operation. Maybe there is less desire to think and reason *in abstracto*, for reasons demonstrated by the MMPI, but the actual faculty of abstract thinking seems not to be affected appreciably.

The only tests showing more marked deterioration were those requiring a certain manipulative ability *in abstracto*, such as Repeating Digits Reversed, and Orientation on S.A.III level. Mental processes involved in this test seem to be affected by the operation.

CHART VI.

Number of digits.		Percentage of scores passed. Pre-		Percentage of scores passed. Post-
4	.	100.0%	.	91.3%
5	.	66.6%	.	41.5%
6	.	41.5%	.	33.3%

There was a loss of two points on the average score on Matrices. Selection after operation was more haphazard and careless. This loss, however, should be considered in the light of the decrease in time required to complete the test after operation.

Speeding up of mental processes is one of the outstanding effects of the operation. Lessening of tension, loss of retardation, and loss of fear of failure contribute as much to this quickening of mental activity as the newly acquired "don't care" attitude. There was a decrease of 42 per cent. in the average time required to complete the MMPI, and 48 per cent. to complete the Matrices. Neither were limited for time ; both require decision in a situation where at least three possibilities have to be taken into consideration. "t" score of Kohs show a STRONG TREND of the scores to increase. One of the main causes for this increase is certainly greater speed. The test is limited for time, and scoring on the same pattern is graded according to the amount of time required.

The following points emerge on summing up the results of intelligence tests :

(a) It is possible to detect and assess personality changes after leucotomy by psychometric testing ;

(b) tests used at present are too crude, and lack the necessary grading and differentiation.

While there is evidence that the faculties for higher mental processes are unimpaired, there is equal evidence that they are operative in a lesser degree after operation. Hence the belief that the patient loses his ability of abstract

thinking, or of forming higher moral concepts. The decrease in accuracy, the haphazard way of answering questions, or performing tasks after operation connects with that loss of pride and sense of responsibility brought out so vividly by the MMPI. A fundamental change seems to take place, and the nearest approach to it seems to be the change in statements relating to early childhood and early experiences in the MMPI. Whether the suggestion that something resembling regression on a large scale is at the root of the changed attitudes and behaviour of the post-leucotomy personality holds good, will have to be decided outside the provinces of psychological testing.

The great weakness of psychological assessment of the effects of leucotomy is the assumption that one is dealing with the effects of a well-defined and accurately localized operation, affecting identical parts of the brain in an identical way, from which identical results can reasonably be expected. We know that this is not the case.

In view of the changing nature of the operation it is the study of the well-authenticated individual case that will form the basis of a more reliable assessment of personality changes after leucotomy. That is why case histories are appended. The data have been compiled from excerpts of psychiatrists' notes and psychiatric social workers' reports. The writer knew and tested each case and was able to compare observations from her own experience.

Cases are described in three paragraphs: The first gives the development leading to operation; the second the early history; and the third, follow-up after operation. The three letters behind the diagnosis denote: Sex, age, state (married, single, etc.).

1. Schizophrenia. M : 28 : S.

He became increasingly nervous and developed delusions and ideas of reference while serving in the Merchant Navy. He was discharged from the Service after treatment in a military mental hospital; was certified and admitted to hospital at the age of 26. He was restless, hallucinated, deluded, aggressive and homicidal.

He was the only child of a kind and protective mother who spoilt him all his life. According to her he was a healthy boy, quite good at school, winning a scholarship to grammar school. When there, however, he did little work and took no part in games. He joined the Merchant Navy as a deck-hand at the age of 17, but rose no higher than able-bodied seaman. He had a few friends, but no hobbies or interests.

Follow-up after operation.—He improved and has now been employed at a saw-mill as a labourer, for about a year. He married and his home-life seems reasonably well-adjusted. Though he still shows signs of hallucinations, paranoid ideas and compulsive thinking, there is no more tension, or urge to act upon these ideas.

2. Schizophrenia. M : 33 : S.

He first showed signs of mental disturbance at the age of 24. He was deluded, persecuted, inclined to attack people, and thought he was receiving telepathic messages. He was sent for a rest to a remote village in Wales, and from this time dates his intense hatred of the Welsh, although half Welsh himself. He entered hospital as a certified patient at the age of 28. He improved and was discharged 9 months later. He became homicidal and suicidal; was certified and readmitted a year later.

He was the second eldest and had two sisters. Quiet and solitary as a child, he was said to have always preferred work to pleasure. He was a fully qualified sanitary inspector before the age of 25. He tried to enlist but was rejected because

of his short-sightedness. He was a good cricketer and footballer, and altogether a capable person.

Follow-up after operation.—He is still in hospital. There is no material change in his mental state. He is still aggressive and paranoid at times, but to a lesser degree. He works occasionally.

3. Obsessive compulsive state. M : 52 : S.

He had obsessions from early childhood. He was afraid of being buried alive and remaining in "everlasting hell-fire." The tendency to compulsive thought increased and he gradually developed a system of counteracting the effects of blasphemous thoughts and sins committed, by reversing every action; walking backwards when taking direction away from home, walking forward when returning, etc. His first serious breakdown occurred at the age of 25, after which he spent 5 years in bed. He entered a hospital at the age of 40.

He was the second of three children in a family of rigid Welsh nonconformist principles. His father was a butcher and inn-keeper in a small mountain village. Apart from religious fears his childhood was happy, and he shared the life of the village community. As a child he was gentle, honest and popular with other children. He was good at school, particularly at drawing and handwork. On leaving school he became an apprentice fitter at a steel works. He worked in a munition factory during the first world war, and as a garage hand after. He was engaged for several years, but he himself broke it off on entering hospital.

Follow-up after operation.—He is still in hospital. He still reverses his actions and walks backwards as before, but he is less worried, and his obsessional thoughts are less intense. He started having epileptic seizures seven months after operation. He is working as a fitter in the same capacity as before. His demeanour shows less care and concern, and he was seen masturbating in the fields while stroking horses and cows. He now admits unusual sex practices and many more obsessional traits than before operation.

4. Schizophrenia. M : 28 : S.

He showed the first signs of mental disturbance at the age of 19 when on leave from the Army. He became withdrawn and extremely retarded in movement and speech. He had ideas of persecution, was hallucinated and often wandered. He was invalided out of the Army after treatment in a military mental hospital and entered hospital as a voluntary patient at the age of 22. He left after a few weeks, but was soon readmitted as a certified patient.

He was the older of two boys and strongly attached to his mother, from his earliest days. He was a solitary child, had no friends, and had never shown interest in girls. He was bright at school; matriculated and became a laboratory assistant. He joined an infantry regiment but was discharged a year later.

Follow-up after operation.—He is still in hospital and is still withdrawn and takes no interest in anything. His habits are faulty at times. Such work as he does, he performs in a mechanical way, requiring much urging and encouragement. He now shows mannerisms not observed before operation: Speaking phonetically, performing stereotyped movements when talking, jumping the two bottom steps at the end of a flight of stairs, etc. He now admits to compulsive counting, fetishism, and a fascination for fire; also to having played with dolls.

5. Schizophrenia. M : 25 : S. (Brother of No. 4).

He showed the first signs of mental disturbance at the age of 15, on his brother's return from the Army with a severe mental breakdown of a schizophrenic nature. He became withdrawn, refused to see his friends, and lost all self-confidence. He again broke down while serving in the Navy, at the age of 22. He was hallucinated, neglecting himself, and acted in a bizarre and absurd way (eating faeces, drinking urine, etc.). He entered hospital as a certified patient.

He is the younger of two boys of a domineering mother who always favoured the older boy. There is a suggestion that she forced patient into military service, as she thought it would be good for the elder brother if they were separated. He was an active boy, said to have been average at school. He was quite popular

and had several friends. He worked as a clerk after leaving school. His development seems to have been strongly influenced by his schizophrenic brother.

Follow-up after operation.—There was some improvement; his habits were clean and he worked regularly in the Occupational Therapy Department. However, he developed epileptic seizures 11 months after operation. His habits deteriorated; he masturbates, hoards rubbish and he does not mix. He works in a half-hearted way. He never left hospital.

6. Depression with schizoid features in obsessional personality. M : 47 : S.

He developed a severe state of anxiety with depression and marked feelings of guilt about supposed errors in account books, culminating in an attempt at suicide by strangulation. He was agitated, hallucinated and had ideas of reference. He was certified and admitted at the age of 47.

Nothing is known about his early history.

Follow-up after operation.—He showed a marked tendency to perseverate during convalescence. He improved and returned to his former work. However, he proved careless, unreliable, lacking all sense of responsibility. He had to give up his work, and he now engages in various activities in a haphazard and feckless way.

7. Schizophrenia. M : 37 : S.

He was invalided out of the Army with a diagnosis of hebephrenic schizophrenia, and was admitted as a certified patient. He had grandiose ideas about miraculous powers and thought he was being persecuted by the police, the B.B.C., etc.

He was the third child of a drunken father and a sensitive mother, who both died of consumption when patient was still a child. He was brought up by an uncle and aunt to which latter he was greatly attached. Though solitary and aloof, he was generally well liked. He was fond of animals and children; was never interested in girls, and preferred the company of older men. He became a grocer's assistant on leaving school, and held the same job for fourteen years, before joining the Welsh Guards.

Follow-up after operation.—He seemed to improve, left hospital on trial and started work as a storekeeper. His work was satisfactory, but he soon got into trouble because of his persecutory ideas, denouncing people to the police, etc., and he had to return to hospital.

8. Paraphrenia. F : 49 : S.

She was brought home in a coma while serving in an Army canteen at the age of 43. During the coma—lasting a month—she would not speak and would take food only from one person. Afterwards she was hallucinated, had compulsive thoughts, talking to herself and stood staring in the same position for hours. She was depressed and mute at times. She entered hospital as a voluntary patient at the age of 49.

She was the eldest of four children. Her mother died when she was 3. Her father remarried after she went into domestic service. As a child she was quiet and had few friends. She was prim and old-maidish, and never interested in boys. She was not bright at school, but proved an excellent housekeeper, holding a position for 23 years. She was directed into a munition factory at the outbreak of war, but was moved to an Army canteen because the other girls were "rough." She visited her home regularly, but was not particularly attached to the family and has developed a positive dislike to her father.

Follow-up after operation.—There was temporary improvement. She left hospital, but was readmitted after a year. She is still hallucinated, withdrawn and apathetic, and mute at times. Apart from clean habits she would do nothing on her own initiative. She is docile if directed or supervised.

9. Obsessional compulsive state in schizoid personality. M : 32 : S.

He became depressed with severe headaches and insomnia at the age of 32. He broke off his engagement, lost interest in everything, and developed compulsive thoughts (cutting his throat when shaving, striking children, hating people, jumping in front of cars, etc.). He entered hospital as a voluntary patient.

He was the eldest of seven children. As a child he was shy, diffident in making friends, and uncommunicative towards his family. He reached top standard in an elementary school and went to work in a colliery. He had an accident resulting in the reduced use of his right hand. Subsequently he left the colliery and worked for a greengrocer.

Follow-up after operation.—He made a good recovery and he is now working for the same firm as previous to operation. He seems well, leading a normal life, and has become a regular church-goer.

10. Manic-depressive psychosis. F : 39 : S.

She suffered from gastric ulcer, with haematemesis. Periods of depression alternated with aggressive behaviour; in the latter phases she was dangerous to herself and others. She attempted suicide by strangulation. She was admitted as a certified patient at the age of 35; improved on treatment and left hospital after 5 months. She was readmitted as a voluntary patient 2 years later. By this time she showed the picture of a typical manic-depressive.

She came from a family of farmers and was the youngest of four. She reached top standard in an elementary school. She was moody, jealous, and always difficult to handle. She was solitary, did not mix well, and never had a boy friend. She managed house work, but was not a good housekeeper. She would not leave home to take up work offering more distraction.

Follow-up after operation.—There was some improvement. She worked as a companion-help and later as a ward orderly in a general hospital. She was certified and readmitted in an acute manic state, since when her condition has been unstable. She had a *grand mal* epileptic seizure 2 years following operation, followed by status epilepticus. She has put on two stones; is careless and easily satisfied.

11. Hebephrenic schizophrenia. M : 26 : S.

He had a breakdown while serving in the Army during the Burma campaign. He was hallucinated, deluded and had ideas of persecution and unworthiness. He underwent a course of prolonged narcosis and insulin therapy in two different military hospitals, and was invalided out with a diagnosis of hebephrenic schizophrenia. He was well enough on his discharge to stay at home and work as a quarryman. However, he relapsed, became violent towards his family, was certified and admitted to hospital.

He was the second eldest of six children. His mother was "nervous," his father not living with his family. He was a solitary child, shy and a day-dreamer, avoiding the company of girls. He was good at his school work and at games. He attained matriculation standard and was employed as a clerk until he volunteered for the Army when not yet 18.

Follow-up after operation.—There was no material change after operation. He was hallucinated, restless and aggressive, and he did not work regularly. His habits were faulty. He walked around incessantly, hesitating before commencing to walk, with the regularity of a ritual. However, he seemed to improve recently and he has been discharged on trial. He resumed his old work during his discharge, but was, so far, given only light duties. According to his mother he again is performing rituals with increasing frequency, and is dependent on her "in a little boy's way, sometimes."

12. Schizophrenia. F : 25 : S.

She showed the first signs of nervous instability during the blitz in London, where she had been in several bombing incidents, at the age of 19. She became suicidal, impulsive and uncontrollable at times, depressed and mute at others. She received treatment as an in-patient in several mental hospitals before she was admitted at the age of 24.

She is the second eldest of a family of three and had a grammar school education. She trained as a shorthand typist and held a secretarial post for several years. She was separated from her family who were evacuated during the war.

Follow-up after operation.—She seemed to make a good recovery. However, after working as a secretary for a few months, she broke down again, was certified and readmitted 18 months later. She was violent and actively suicidal. She

again recovered and started training as an arts teacher. She now seemed well adjusted, passing her exams and popular with her colleagues. She then again had a relapse, but resumed her studies after a two months' stay in hospital, and is doing well.

13. Paranoid schizophrenia. F : 54 : M.

She had a nervous breakdown at the age of 25, probably following the breaking off of her engagement to the man she married 14 years later. She developed persecutory ideas and an obsessional pre-occupation with death, after her husband went on war service. She was depressed, over-anxious, suffered from insomnia, loss of memory, and had frequent emotional outbursts. Her symptoms became more pronounced on her husband's going abroad. She was treated in two different mental hospitals for about a year, before she was admitted as a certified patient at the age of 54.

She was the second of a family of four. She spoke of her mother as a stern and rather harsh woman who drove her husband and her children. She herself was gentle and unselfish, with a rigid code of behaviour. She was a college-trained teacher, qualifying with honours, and an accomplished musician. She was teaching for 14 years before marriage. Her husband was her inferior, intellectually and socially. The marriage was a reasonably happy one.

Follow-up after operation.—There was temporary improvement. She was still paranoid and mildly grandiose, but there were no more emotional outbursts. However, her habits deteriorated; she became slovenly, unwilling to work, and neglected her household to such an extent that it seriously affects her home life and her husband's health.

14. Chronic obsessive-compulsive neurosis with conversion symptoms. M : 49 : M.

He had compulsive thoughts of an obscene nature, accompanied by severe headaches for about three years. He had feelings of unreality and several spells of insomnia. He twice spent short periods in a mental hospital as a voluntary patient. He became suspicious of the relationship between his wife and his step-daughter's fiancée. He entered a mental hospital for the third time at the age of 49.

He was one of seven children of an "extremely religious" father. He had an elementary education and joined the Merchant Navy. He drank heavily, then became a teetotaler. He was always "very serious minded" and religious. He married a widow with two daughters and had himself five children.

Follow-up after operation.—There was some improvement. He left hospital and settled reasonably well at home. He was unwilling to resume work and has now been without regular employment for about a year and a half, and although he insists that he wants to work, he does everything to avoid it. He complains of his "bad thoughts" returning with increasing strength.

15. Hebephrenic schizophrenia. M : 28 : M.

He developed nervousness and anxiety while serving in the Air Force. The Service Psychiatrist described him as depressed and temperamentally unstable. He later developed peculiar ideas and auditory hallucinations. He was invalided out, certified and admitted to hospital, at the age of 26.

He was the older of two children and it is said that his mother rejected him. He was brought up by his grandmother, who over-indulged him. He had an elementary education; was trained in the Air Force as an electrician and served there in this capacity. As a child he was retiring, bad-tempered and had few friends, but showed no abnormal symptoms before joining the services. He married at 23. He had a tendency to violence after leaving the services, and his wife described him as "Changed, has a strange look in his eyes, and is occupied with another world."

Follow-up after operation.—He improved generally, but he still remained solitary and lacking in initiative. He was less depressed and had more insight. He lived with his wife for some time, but was readmitted in a manic state. He now developed feelings of guilt about masturbation. He only works when he feels like it.

16. Schizophrenia. M : 36 : S.

He became depressed, hallucinated and developed ideas of reference at the age of 32. He made several attempts at suicide. While in good health before, he now developed disorders of the digestive system. He stopped working and stayed at home, occupying himself, but avoiding contacts. He entered hospital as a voluntary patient two years after the onset of symptoms. He left against advice and was readmitted two months later.

He came from a family of miners, and was the fifth of eight children. As a child he was retiring, but well liked by the few friends he had. He has never been interested in girls, and was always attached to his mother, who was inclined to over-protect him. He was bright and reached top standard in an elementary school. He became a miner at the age of 14, and was an efficient and reliable worker, trusted and respected by his superiors.

Follow-up after operation.—His condition improved. He was more sociable, mixed more easily, and enjoyed going to places of entertainment. He did temporary work for a short time, and then returned to his former work. He worked well and was happy for some time, but he again developed ideas of persecution and reference and is now back in hospital.

17. Schizophrenia. M : 39 : M.

He developed delusions and persecutory ideas, accompanied by depression and anxiety following war service as a gunner in India. He was invalided out on the grounds of "psychopathic personality with emotional abnormalities." He was hallucinated, voices telling him to do things. He accused his father of misconduct with his wife and threatened him. He was certified and admitted at the age of 39.

He was a happy child, healthy and quite bright at school. He worked in a colliery from the age of 14 until he was 26, when he became a casual labourer, until called up. He was an active member of the Plymouth Brethren religious community.

Follow-up after operation.—His condition improved. He was cheerful, unworried, but euphoric at times. He helped in the home and worked as a casual cleaner. He started having epileptic seizures six months after operation, and was readmitted in a manic state.

18. Hebephrenic schizophrenia. M : 25 : S.

He became apathetic and withdrawn at the age of 16, when just about to leave school, and spent a year in a mental hospital. He was hallucinated, showed no interest in his person, or in his surroundings. He had occasional emotional outbursts and one attempt at suicide. He remained self-absorbed and solitary, and again entered hospital as a voluntary patient at the age of 22.

He is the only child of business people in fairly comfortable circumstances. He was sociable as a child, but inclined to shyness as an adolescent. He was educated at a public school, was considered bright, and attained higher school certificate standard.

Follow-up after operation.—There was no material change after operation. He still lacks drive and does not engage in spontaneous conversation. He works in the Occupational Therapy Department, but needs constant encouragement, and seems incapable of concentrating on one thing for any length of time. He developed an initial stammer of varying severity.

19. Manic-depressive psychosis. M : 52 : M.

He first showed signs of depression and elation at the age of 47, and spent some months in a mental hospital. He returned to his work, but became increasingly difficult, accusing his colleagues and superiors of persecuting him. He was certified and admitted to hospital five years later.

He was the eldest of three children and had a nonconformist upbringing. His father committed suicide when he was 12. After this his relationship to his mother was never happy. He was a brilliant scholar and a good musician. He held several teaching appointments and became headmaster of a well-known school. He married early and according to his wife, his home life was happy. He has four children. He was an officer in the first world war.

Follow-up after operation.—For some time he seemed to improve. He went back to his family, but made life intolerable to them, and he had to return to hospital after a few weeks, remaining in a more or less hypomanic state. He now is deluded, has ideas of grandeur, is interfering, writing slanderous letters, and making himself difficult in every way. He had a *grand mal* epileptic seizure nine months after operation.

20. Anxiety hysteria. F : 29 : S.

She had a history of anxiety and insomnia since early childhood. She left school for fear of sitting examinations, and developed severe anxiety states in the middle twenties. She lost weight and worried unduly about other peoples' opinion of her. She underwent psychiatric treatment in both out-patients' departments and mental hospitals, and there was improvement for short periods. She then started work in different places, but she invariably broke down after a short time. She entered hospital as a voluntary patient at the age of 29.

She is the older of two girls. Her mother was given to depression and excessive worrying. Patient was shy and nervous as a child, always complaining of lack of ability to make friends. In later years there was the added fear of not being attractive to men. She was an average pupil and worked as a shorthand typist after leaving school. She could not get on with her colleagues, and changed her jobs several times. She is a good singer and has taken part in competitions and concerts.

Follow-up after operation.—There was some improvement. She was more cheerful and found it easier to mix. She resumed work as a shorthand typist, but was declared "redundant" after a few months, and after several similar experiences returned to hospital as a voluntary patient in a hypomanic state.

21. Schizophrenia. M : 29 : S.

His early history is suggestive of emotional instability, but he himself dates his first breakdown from an incident in action during the Sicilian campaign at the age of 23. He developed severe depression with headaches, during which he tended to be violent. He made several suicidal attempts and had expressed homicidal urges. He spent several periods in military and mental hospitals and neurosis centres.

His father was a quarryman and he was the second of six children. He received an elementary education and was said to be bright. He worked as a storeman and slate-dresser in a slate quarry before joining the Army.

Follow-up after operation.—There was some improvement. He lost his former tension and "world hostility." He became cheerful and somewhat elated, but at the same time he was unconcerned, showing a certain shallowness, and he could not settle to any work. He died from burns when his clothes caught fire. There was no conclusive evidence whether this was due to a suicidal attempt or accident.

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FURTHER OBSERVATIONS ON THE USE OF COMBINED PHOTIC AND CHEMICALLY INDUCED CORTICAL DYSRHYTHMIA IN PSYCHIATRY.

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THE work of Cossa and Gastaut (1) and Gastaut (2) indicated the possibility of inducing a cerebral dysrhythmia, consisting of fast spikes or a fast spike followed by a slow wave, by a method of combined metrazol and photic stimulation. Modifying their technique and substituting hexazol (triazol) for metrazol O'Flanagan *et al.* (3) treated a series of cases with encouraging results, and in view of their findings it was decided to investigate the method further, and examine the effect of the induced dysrhythmia with special reference to psychiatric disorders.

TECHNIQUE.

This was similar to that used by O'Flanagan *et al.*, the patient being given a light breakfast on the morning of treatment, but no other special preparation.

An intravenous injection of hexazol is given, the dose varying with the weight of the patient, and being approximately 0.5 to 0.8 c.c. of a 5 per cent. solution; the lowest dose employed was 0.1 c.c.

The optimum amount, called the Myoclonic Threshold, is that quantity which with intermittent photic stimulation will produce a Myoclonic Response (M/R). This term is used by Gastaut and Hunter (2) to describe a clinical response represented by myoclonus predominating in the upper limbs, and coupled with bilaterally symmetrical E.E.G. recordings of multiple spikes or multiple spikes followed by a slow wave and is modified in this paper to include myoclonic movements of the facial musculature.

The injection is given slowly to avoid the induction of a full convulsion, and also to produce a maximal effect at the level of the thalamic system (Gastaut and Hunter (2)).

When the optimum dose is given no alteration occurs in the E.E.G., and no subjective experiences are noted by the patient until photic stimulation is applied.

The light stimulus is derived from a Varistrobe at a flash frequency (F/S) varying from 10 to 30 per second.

On commencing photic stimulation the patient shows M/R in which the myoclonus may be confined to the facial muscles, but generally spreads rapidly to the upper limbs. Prolonged stimulation may cause the response to become generalized, to become submerged in a tonic contraction or to pass into a full

convulsion, and for this reason the light is not usually applied for single periods of more than 15 seconds. M/R's are elicited for a total period of 5 or 10 minutes, when withdrawal of the lamp allows complete relaxation of the patient, who neither loses consciousness, nor is too apprehensive or distressed by the procedure.

The stimulus is applied with the eyes closed since stimulation with the eyes open causes inhibition of the myoclonus and cessation of the cortical dysrhythmia (Fig. 1).

Facilitation of the M/R is produced by eye closure after exhibiting the light, and also by a surge from low to higher F/S; similar effects are reported by Grey Walter (4), using physiological stimuli. In some patients the M/R was facilitated by alternating the stimulus from eye to eye. Treatment is given daily or three times a week, but no definite rule is made and each case is judged on its merits; similar remarks apply to the number of treatments given.

Full convulsions may be considered necessary for therapeutic purposes, and these may be induced by commencing photic stimulation before the injection and/or by injecting the drug rapidly (Cossa and Gastaut).

DESCRIPTION OF VARISTROBE.

Since the instrument is required to run at low frequencies and a free running Neostron lamp is inherently unstable at low frequencies, it is essential that the lamp is triggered from some other stable source. In view of this the basis is a sawtooth generator of the Miller type which triggers a Neostron lamp. The constants of the lamp circuit are so adjusted that it cannot strike unless a negative pulse of 30 v. peak to peak is applied to the grid. Considering the circuit in more detail, the first stage is a Miller sawtooth generator. This is arranged to produce a negative-going sawtooth wave at its anode, the frequency of which is variable from 5 c/s to 50 c/s in one range. This frequency is greater than would normally be covered in one range, as at the higher frequencies the flyback time is equal to the forward stroke.

The ratio of 10:1 between the maximum and minimum frequencies cannot be exceeded with this circuit, as the amplitude of the sawtooth wave form is considerably reduced at the high-frequency end of the range.

It is, however, unnecessary to extend the range above 20 to 25 c/s, as no myoclonic response is thereby elicited. The frequency at which a good M/R is obtained is not critical, but approximates to the alpha rhythm of the patient.

The flash frequency is quite stable, and is not affected by mains variations in the order of 10 per cent.

The instrument is entirely self-contained, and is housed in a case measuring 11 in. high by $7\frac{1}{2}$ in. wide by $7\frac{1}{2}$ in. deep. A power supply of 200-250 v., 40-60 c/s is required, and the weight of the instrument is 10 lb. The flash tube is mounted in a suitable holder which carries a reflector, and this assembly stows in a pocket in the case for carrying.

ILLUSTRATIVE CASE HISTORIES.

1. *F. S—, female, 45 years.*—Was admitted to Hill End Hospital complaining of depression and lack of energy. She had suffered from recurrent depressive



FIG. 1.—E.E.G. record to show facilitation of response on eye closure.

episodes for 20 years, each attack lasting on the average about three months. The most recent attack, which started six months before admission, had outlived the others in duration, and was characterized by depression, retardation, and the inability to carry out routine domestic tasks. The menopause had occurred two years previously, and there was a negative family history for nervous or mental disorder.

Patient was given three treatment sessions, which were followed by a dramatic improvement, and she was discharged a month after admission, apparently quite well.

2. *M. G—, female, 33 years.*—This patient had been under treatment as an in-patient for about nine months before she was treated with hexazol/photic stimulation. At the time of admission she was agitated, depressed, and had suicidal ideas. She had previously supported her illegitimate child, but had lately failed with her work and had become extremely hypochondriacal. Prolonged psychotherapy had effected some improvement in her anxiety symptoms, but her slow progress in other respects suggested the need for physical treatment. She was given hexazol/photic stimulation over 11 sessions in lieu of E.C.T., and with very good effect. A month after the commencement of the course she had taken her discharge, having previously found herself employment and, three months later she was still working well and symptom-free.

3. *A. T—, female, 30 years.*—This patient had a traumatic childhood and was sexually assaulted by her father at an early age. Nevertheless she subsequently made a good emotional adjustment with her husband and children, and appeared normal in every way until she impulsively killed her youngest child. The act of infanticide took place after she had finished breast-feeding the child one morning, and in her words, "something came over me and I felt the child was coming between my husband and myself, so I dashed it to the floor." She had no amnesia for the incident, and in relating it showed little affect.

A charge was preferred, and whilst patient was in custody and awaiting trial she became depressed and apprehensive concerning the future; she worried over the prospect of a long prison sentence, and also because she thought her husband might divorce her. She was, however, placed on probation, and went into a mental hospital as a voluntary patient for two years before being referred to the Neurosis Centre at Hill End Hospital. Here she was first treated by abreaction, using chloroform, but in view of the later appearance of depressive symptoms was given a short course of hexazol-photic stimulation, with no apparent improvement in her condition.

Although the patient gave no history to suggest epilepsy, her sister had had "fits" which ceased at puberty, and a routine E.E.G. taken during the course of hexazol/photic stimulation showed widespread theta activity, which remained constant throughout. A later routine recording showed evidence of psychomotor epilepsy, and this pattern became more evident following the injection of 10 units of insulin.

This patient illustrates the difficulty which may occur in diagnosing epilepsy, and will be referred to again later.

SUBJECTIVE EXPERIENCES.

A mild euphoria was frequently encountered after treatment, and the following experiences were reported by various patients:

- (a) Seeing coloured patterns; one patient later painted a flower design based on the colours seen.
- (b) Dryness of the mouth and feelings of thirst.
- (c) Sensations of cold or feelings of being frozen.
- (d) Sensations of warmth, which become extremely pleasurable.
- (e) "A feeling that something is going to happen, but doesn't quite."

(f) An urge to cry out.

(g) Illusory conversations, the content of which could not be recalled.

(h) Nightmarish dreams. One patient dreamt that she was having treatment, and in response to the flicker developed myoclonus which woke her up. The myoclonus was noted by her husband.

Two patients noted that their vision was clearer, and one who had a unilateral retinal detachment spoke of increased light perception in the affected eye; during treatment illumination of this eye produced a diminished M/R as compared with the response elicited through the normal eye.

Another patient developed hyperventilation tetany during the initial treatment, but this was probably emotionally determined.

The following are diaries kept by patients during treatment :

Patient J. E.—“The treatment gives two distinct sets of feelings; one accompanies the injection, the other the lamp. Generally the feelings follow a predetermined pattern in both cases, but on Thursday and Tuesday treatment gave different feelings through no apparent reason.

“After Tuesday’s treatment I felt a sensation in my head which can best be described as a feeling that ‘somebody had been tampering with my brain.’ I also experienced short-lived, slight pains in varied parts of my head. All these feelings were missing after Thursday’s treatment, and I cannot remember experiencing them previously.

“General Feelings due to Injection.

“The injection is followed by a feeling of complete lack of control of the body. This, however, is not so, since one is able to move it at will.

“*Tuesday.*—The injection was followed by a sudden horrible sensation of being in another world, far away from everything and everybody, and unable to return to the ‘real’ world. Nevertheless I could distinctly hear and understand voices of people talking around me. These feelings were accompanied by alarming palpitations of the heart, and almost uncontrollable ‘twitchings’ of the limbs. To prevent these ‘twitchings’ I had to keep as tensed up as possible.

“*Thursday.*—I was given a sedative before the injection, and experienced the general reactions mentioned above.

“Feelings Experienced Due to Lamp.

“*General.*—The main colour I see is red. Usually it is formed into triangles, which enter my vision at the upper right-hand side and fall to the bottom left-hand side. They increase in number and speed until they seem to ‘explode’ into a convulsion. Alternately I see a pinpoint of red light in the centre of my vision, which develops into a spiral and spins with increasing speed until it too ‘explodes’ into a convulsion. I do not feel anything in the sense of pain, but I have an increasing feeling of fear. When I am told by the doctor to ‘open my eyes—look at the lamp—close my eyes tightly,’ I have an immediate convulsion with no preceding appearances of colours or shapes.

“*Tuesday.*—The light seemed brilliant red. On opening my eyes and looking at the light and then closing them again, I experienced what is best described as an ‘electric shock,’ which passed through my head and my entire body and thoroughly terrified me. With my eyes closed I again saw the triangles, but the colour was much more brilliant than before. I was so terrified that I was almost unable to open my eyes when requested to do so, and having forced myself to open them, I needed even greater will-power to close them, knowing that this terrifying ‘electric shock’ was in store for me. I was so frightened I felt I wanted to scream, but forced myself not to, yet involuntarily moaned instead.

“*Thursday.*—The light was blue in colour, and as well as the triangle I saw large square shapes falling from the top to the bottom of my vision, but neither they nor the triangle succeeded in reaching the terrifying speed which precedes a convulsion, and I experienced no convulsion during this day’s treatment. (This lamp was less brilliant than the one normally used.)

"To sum up in a few words, the general feeling I have under this treatment is that I leave this world and journey through space to another. This 'other' certainly is not heaven, but certainly does resemble the other place!"

This patient was the one who later commenced laughing during myoclonus.

Patient A. P.— "*Waiting for 1st treatment.*—Quivering and thudding inside with unsteady hands. Cannot listen to varied accounts of other patients' experiences of illness and operations, and shy away in horror.

"*1st treatment.*—Little sensation from injection except slight prick of needle, and a weak helplessness probably caused by fear and lying in such a flat position on a bed. Conscious of flickering torch-like instrument being passed over eyelids at intervals accompanied by ticking or clicking sound, sets of coloured squares and shapes of light very definite and singularly beautiful. A feeling of relief that if this is all the treatment means—nothing to be afraid of! Slight weakness on getting off bed and stiffness in arm from injection. Hands too shaky to hold glass of milk steady to lips for five minutes. This passed off and ate a fair dinner within 15 minutes of treatment. Went to painting class in afternoon.

"*2nd treatment.*—Same feeling of inward fear. Felt slight surge of something through body after injection. No colours this time, mostly flickering points and stars of light. Twitching of nerves in body and legs. Great comfort from someone's hands holding mine. Begin to feel things are going to be more difficult than anticipated. Get tiresome and grunt and try to avoid the light. No stiffness in arm. Unsteady for an hour to two.

"*3rd treatment.*—Little different from 2nd, though no feeling from injection except inward trepidation over the whole business.

"*4th treatment.*—Think this was the one when felt eyes being drawn out of head by light—not painful, just peculiar. Slight headache for an hour or two—cleared later.

"*5th treatment.*—Think this was the one during blood tests. Am told to open eyes to light—as far as I can tell for the first time. Not so twitchy, but long strain with tests, etc. Walked back to ward with help of nurse. Stayed in bed until after dinner.

"*6th and 7th treatments.*—Beginning to control feelings, but still like to hold the hands which are always comfortingly near. Clicking and flickering goes on—no colours—can see Doctor's face quite clearly when eyes open. Recover more quickly now after treatment.

"*General.*—Aware of various people in treatment room throughout, but only Doctor and the one holding my hands seem to matter. After seven treatments feel very much more myself—can walk without any hesitation, but am wondering if my confidence will return to go out alone, and any distance, without turning to hurry back. Can listen to a certain amount of 'operation and illness' talk now without wanting to turn and run."

CASE MATERIAL.

In this paper no attempt is being made to analyse the results obtained, as too few patients were treated to produce significant figures. Below is a short summary of the patients investigated, and who were taken at random from those who had been admitted to a neurosis centre over a period of twelve months.

In all 35 patients were treated, and of these 12 were males and 23 females; 9 patients had been given E.C.T. at some time within the past twelve months without improvement, and 5 others had received courses of deep insulin therapy. Of those who had previously received no physical treatment of any kind, 11 patients were suffering from depressive syndromes.

The patients are classified according to the diagnosis in Table I.

The most noticeable improvement was observed in patients suffering from depressive illnesses, but one patient who was in stupor failed to respond. One

TABLE I.

Diagnosis.	No. of cases.	Diagnosis.	No. of cases.
I. Schizophrenia—		III. Obsessional states with	
(a) Hebephrenic	2	depression	1
(b) Catatonic	2	IV. Depersonalization syn-	
(c) Paranoid	1	dromes	2
(d) Simple	2	V. Epilepsy	1
II. Depressive Syndromes—		VI. Psychopathic personality	3
(a) Manic-depressive		VII. Anxiety states . . .	3
psychosis	2	VIII. Hysteria	2
(b) Involutional melan-		IX. Organic syndromes . .	3
cholia	2		
(c) Hypochondriasis with			
depression	3		
(d) Hypochondriasis			
without depression . .	1		
(e) Reactive depression . .	5		

of our hebephrenic patients was greatly improved after 25 treatments and said "everything seemed more real" afterwards; another patient was completely relieved of depersonalization symptoms.

COMMENT.

The disadvantages of convulsive therapy are well recognized and require no reiteration. In an attempt to offset these disadvantages various modifications have been devised, and are exemplified by the introduction of electrically induced convulsions by Cerletti and Bini (5), and the use of spinal anaesthesia by Hamsa and Bennett (6). Bennett (7) first made use of curare to lessen the risk of fractures, and although the method has been widely adopted it is not without its risks.

The application of subconvulsive technique has proved disappointing in the hands of Kalinowsky *et al.* (8) and Cohen (9), whilst E., E. S., and L. Ziskind (10) concluded that they predispose to therapeutic failures. These methods are said to cause increased apprehension and agitation, and are also believed to produce cardiac dysrhythmia.

Many theories have been advanced to explain the mechanism of convulsive therapy, but none has been entirely satisfactory for a variety of reasons. Meduna, postulating the antagonism of epilepsy and schizophrenia, stressed the essential role of the convulsion, but later modified his view and attributed the effect of metrazol to irritation of the medulla with resultant respiratory vasomotor and autonomic reactions, whilst Meduna and Friedman (11) found little to support the theory of biological antagonism of schizophrenia and epilepsy. Hobson (12), in consequence of his work with curare-modified E.C.T., believed that the muscular contractions were unnecessary for therapeutic purposes. That anoxemia may play a part in the treatment of functional

psychoses has been claimed by Loevenhart *et al.* (13), who produced transitory improvement in catatonic patients by administering a mixture of oxygen and 30 to 40 per cent. carbon dioxide, and this treatment was observed to produce motor manifestations "resembling cerebral convulsive seizures."

The work of Rubin and Wall (14), Golla, Walter and Fleming (15), and Lennox and Gibbs (16) indicates that metrazol, E.C.T. and anoxia can produce similar E.E.G. patterns, but the result is not constant in anoxic states in that the discharge of abnormal cortical potentials commonly occurs during the phase of recovery. The seizure discharge in each instance resembles that occurring in spontaneous epilepsy, and it is tentatively suggested therefore that the therapeutic effect of the various therapies mentioned is linked in some way with the production of a seizure pattern in the cortex. If this is true it would obviously be desirable to produce a seizure pattern with as little risk to the patient as possible.

The suggestion made in this paper that the effects of convulsive therapy can be mediated by the mid-brain centres is supported by the work of Pfister (17) and Gellhorn (18 and 19), who find that there is a reactivation of central sympathetic activity following shock treatment for functional psychoses.

In the present series of patients it was decided to investigate the effect of the cortical changes produced by combined hexazol and photic stimulation, and to examine the blood-sugar changes in a few cases. E.E.G. recordings were taken from the transverse post-central leads, and whilst it would have been more desirable to use pre-central or frontal leads, the former position was chosen in order to minimize interference from muscle artefacts, more particularly as each patient was given a mouth pack to bite upon. The routine in each recording was similar: a short run of resting record was taken in order to investigate the presence of any inherent dysrhythmia, and started again when the needle had entered the vein, and recording was continued until an adequate response had been elicited, or until it was clear that no response was forthcoming.

It was observed that in all but two cases no response was obtained by the injection of hexazol only (see Table II). These cases were Nos. 14 and 8*d*, and in the former a full fit developed some seven minutes after the injection, without photic stimulation. It was suspected from gross changes in the E.E.G. that a convulsion was imminent, and recording was continued throughout until final recovery. In the case of No. 8*d* many larval seizure discharges were seen, and consequently no lamp was used in order to avoid precipitating an unnecessary major convulsion (Fig. 2).

It is presumed that the speed of injection was responsible for these effects, as they failed to appear in Case 14 with a slower injection rate, and in the instance of 8*d* several sessions had been given previously with no untoward effects.

The actual patterns obtained by application of the lamp varied somewhat between patients, but this might be expected, as the seizure patterns of genuine epileptics, whilst following broad orthodox lines, vary considerably in detail (Figs. 3, 4, and 5).

All phenomena observed, however, were typical of those seen in genuine

TABLE II.

Case No.	Resting record.		On stimulation.					Interval between injection and response.	Total record time after injection.					
	Dominant rhythm, freq. and voltage.	Other rhythms, freq. and voltage.	Wave and spike complexes.	Spikes only, voltage.	Slow waves only, freq. and voltage.	Dominant rhythm between flicker.								
1	•	None constant 10-15 μ V. 10-11 c/s and 5-6 c/s	•	3-4 c/s } 150 μ V. 6 c/s }	•	100-200 μ V	•	As resting record, but voltage 40-70 μ V.	•	15 sec.	•	25 min.		
2	•	6-7 c/s 30-70 μ V	•	2-3 c/s 100-200 μ V	•	150-180 μ V	•	4 c/s 100-120 μ V	•	As resting record	•	$\frac{1}{2}$ min.	•	14 "
3	•	9-10 c/s 20-50 μ V	•	—	•	—	•	One burst 5 c/s 50-60 μ V	•	As resting record	•	3 "	•	6 "
4	•	None constant 12 c/s and 5-6 c/s 15-20 μ V	•	—	•	? Muscle	•	4, 5, 6 c/s 30-50 μ V	•	12-14 c/s 20 μ V	•	2 $\frac{1}{2}$ "	•	11 $\frac{1}{2}$ "
5	•	None 5 μ V	•	—	•	—	•	4-5 c/s 50-70 μ V	•	? c/s 5 μ V	•	1 $\frac{1}{2}$ "	•	6 "
6	•	10-14 c/s 20-50 μ V	•	—	•	—	•	6-7 c/s 20-30 μ V	•	As resting record	•	1 "	•	3 $\frac{1}{2}$ "
7a	•	11 c/s 25-30 μ V	•	—	•	80-150 μ V	•	5-6 c/s 20-100 μ V	•	As resting record	•	1 "	•	6 "
7b	•	10-12 c/s 20-40 μ V	•	—	•	50-80 μ V	•	—	•	As resting record	•	$\frac{3}{4}$ "	•	3 "
8a	•	13 c/s 15-20 μ V	•	4 $\rightarrow$ 2 c/s 150 μ V	•	—	•	5-6 c/s 30-80 μ V	•	7-8 c/s 40-60 μ V	•	1 "	•	10 "
8b	•	11-12 c/s 20-30 μ V	•	3 $\frac{1}{2}$ $\rightarrow$ 2 c/s 100-120 μ V	•	50-100 μ V.	•	2-3 c/s 100 μ V 4-6 c/s 50-60 μ V	•	7-8 c/s 30-60 μ V	•	$\frac{1}{2}$ "	•	9 "
8c	•	10 $\frac{1}{2}$ c/s 20-50 μ V	•	—	•	—	•	4-6 c/s 30-60 μ V	•	As resting record	•	1 $\frac{3}{4}$ "	•	8 $\frac{1}{2}$ "

TABLE II—*contd.*

Case No.	Resting record.		On stimulation.				Total record time after injection.
	Dominant rhythm, freq. and voltage.	Other rhythms, freq. and voltage.	Wave and spike complexes.	Spikes only, voltage.	Slow waves only, freq. and voltage.	Dominant rhythm between injection and response.	
8d	10 c/s 20-60 μ V	Random 5-6/s 10-15 μ V	4—→3 c/s 120 μ V	Severe dysrhythmia and spontaneous wave-and-spike complexes occurred $\frac{1}{2}$ min. after injection. No flicker used.	4-6 c/s 50-80 μ V	1 min.	10 min.
9a	10 c/s 30-50 μ V	6 c/s 20-30 μ V 2-3 c/s focal	One only 4 c/s 50-150 μ V	—	4-6 c/s 50-80 μ V	1 min.	5 $\frac{1}{2}$ "
9b		As 9a	—	—	No response.		
9c		As 9a	—	—	3-5 c/s 60-100 μ V	1 $\frac{1}{2}$ "	6 "
10a	10-11 c/s 10-15 μ V	—	6—→4 c/s 100-150 μ V	40-150 μ V	7—→4 c/s 15-20 μ V	2 $\frac{1}{2}$ "	7 "
10b		As 10a	2-5 c/s 80-120 μ V	50-120 μ V	4-6 c/s 30-60 μ V	1 $\frac{1}{2}$ "	5 "
11	11-14 c/s 20-40 μ V	18 c/s 10 μ V	—	50-100 μ V	3-4 c/s 50-120 μ V	1 $\frac{1}{2}$ "	3 "
12a	10 c/s 5-10 μ V	20 c/s 5 μ V	—	—	—	2 "	6 $\frac{1}{2}$ "
12b	11 c/s 20-80 μ V	20-22 c/s 5-15 μ V	—	*100 μ V	6-7 c/s 15-80 μ V	1 "	7 "
13	8-10 c/s 20-50 μ V	5-6 c/s 20-30 μ V	—	100-150 μ V	5-6 c/s 50 μ V	2 "	8 "
14	10 c/s 20-30 μ V	22 c/s 5-10 μ V	Developed major convulsion seven minutes after injection. Lamp not used.		No response.	1 $\frac{1}{2}$ "	18 "
15	11 c/s 10-30 μ V	4-5 c/s 20-30 μ V	—	80-150 μ V	—	3 "	12 "
16	8-11 $\frac{1}{2}$ c/s 15-25 μ V	3-5 c/s 10-20 μ V	—	—	As resting record 5-10 μ V		

* Obtained every time lamp was moved alternately between left and right eyes.

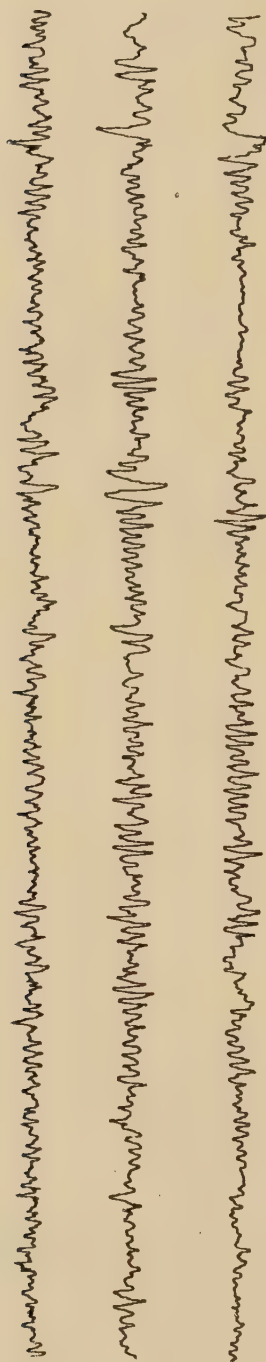


FIG. 2.—E.E.G. record showing larval seizures.



FIG. 3.—E.E.G. record to illustrate the different patterns produced by turning the lamp "on" and "off."

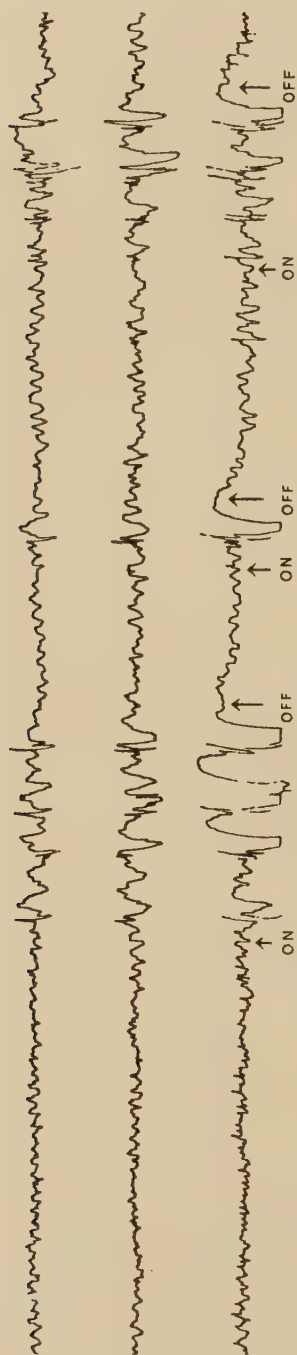


FIG. 4.—E.E.G. record to illustrate the different patterns produced by turning the lamp "on" and "off."

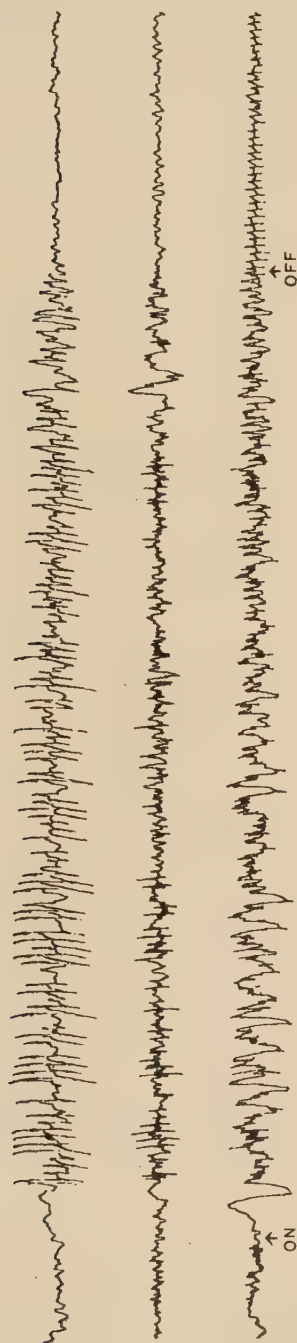


FIG. 5.—E.E.G. record to illustrate the different patterns produced by turning the lamp "on" and "off."

epileptic records. Some features were characteristic of *grand mal*, and others of the *petit mal* variant pattern. Many of the wave and spike variants had multiple spikes associated with each wave, and some of these spike discharges were seen to occur at alpha frequency, with the spike at the crest of, or between, the alpha waves.

The records between the removal of the lamp and its reapplication showed wide variation. About 30 per cent. returned immediately to their resting record, while the remainder showed varying degrees of temporary disorganization. Case 8 was unique in that a progressive slowing of the resting dominant rhythm was noted as the treatments progressed, and when the fourth session was given, showed a more normal frequency of alpha.

The interval between the injection and an evoked response was very variable, being inconstant even in the same patient. Here, again, the speed of injection may have been responsible. In general, the earlier in the record a response could be obtained the greater the extent of dysrhythmia evoked by the lamp. It is realized that an automatic analyser would have been of considerable help in integrating the amount of disorganization produced in each record, but access to one was not possible, and whilst the relative amplitudes of abnormalities have been tabulated, no attempt can be made to summate the overall amount of dysrhythmia obtained, except to integrate the times that abnormal discharges were seen in each record. It was not thought desirable or useful to do this, as without a similar integration of amplitude and frequency over these periods the information obtained would be of little value.

The correlation between the E.E.G. and the clinical manifestations of a seizure-type discharge was interesting. Single myoclonic twitches were accompanied by a single spike in the record, followed by one or more slow waves, and prolonged myoclonus was characterized by multiple spikes.

The conclusion that can be drawn from observations on the E.E.G. of patients during this treatment would appear to be that whilst all the discharges varied widely, even in the same individual, nevertheless they were all of the type traditionally seen in known epileptic records, and thus there is good evidence for assuming that genuine epileptiform dysrhythmia was caused in the cortex by this procedure.

In the short series tabulated it was noted that those cases with a high theta rhythm content in their resting records were apt to show more disorganization than those without any abnormality. Case 2, which had a theta-dominant record to start with, produced a gross response. No facilities existed for trying out the procedure on delta-dominant records, as none were available other than severe abnormalities, to whom the treatment could in no circumstances be given.

Case 15 offers an interesting sidelight on the selection of suitable patients. This particular one had a considerable amount of widespread theta activity in her record, but it was of low voltage and ordinarily would have aroused no interest. The diagnosis was somewhat in doubt, but her history was suggestive of psychopathy, and she was referred for symptoms of depression. The fact that no response was obtained on the occasion mentioned in the table was found to be due to an insufficient dose of hexazol. Subsequent treatments

without E.E.G. records evoked satisfactory myoclonic jerks, but her condition did not progress or improve. A routine E.E.G. showed one high-voltage "flat-topped and sawtooth" complex of 200μ V in all areas, of the type often seen in psychomotor attacks. This case is of interest in this paper, only to illustrate the absolute desirability of determining the E.E.G. pattern before commencing this treatment. This point is emphasized in the case history of patient A. T.—described earlier.

Blood-sugar estimations were carried out on six patients $\frac{1}{2}$, 1 and $1\frac{1}{2}$ hours after the production of a M/R, and in five of these a rise occurred above the fasting levels (Table III). It is difficult to draw conclusions owing to the lack of controls and because of the small number of patients investigated, but it is suggested that hexazol/photic stimulation may produce more measurable effects than those observed clinically. The need for a more complete investigation is recognized.

TABLE III.—*Blood-sugar Levels after Production of M/R (in mgm. per cent.).*

	Fasting level.	$\frac{1}{2}$ -hour after M/R.	1-hour after M/R.	$1\frac{1}{2}$ hours after M/R.
1	107	109	119	115
2	98	104	99	94
3	104	118	104	111
4	111	100	104	93
5	108	117	110	113
6	90	98	103	100

SUMMARY.

1. A technique for the production of cerebral dysrhythmia is described.
2. The subjective effects and clinical responses in a small series of patients are recorded.
3. Suggestions are made concerning the possible therapeutic use of this method.
4. The E.E.G. findings are reported.

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CRIME IN THE PSYCHOSES COMPLICATING PELLAGRA.

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THIS paper deals with the relation between crime and the psychoses complicating pellagra, and is based on a study of the cases of accused persons suspected of being insane, and admitted to the Abbasia Mental Hospital for mental examination and report during eight years from 1941 to 1948 inclusive. This examination was, in the great majority of the cases, carried out by the writer who, in virtue of his official position, is the expert psychiatrist to the Office of the Procureur-General.

Pellagra is a world-wide disease which has intrigued and is still intriguing investigators since its identification in Southern Europe during the first half of the eighteenth century. The literature on the subject is so voluminous that the number of references is sure to run into well over a thousand.

The exact nature and pathogenesis of the disease are still obscure, and rival theories have been propounded in explanation of its causation. The oldest is, of course, the maize-eating theory from which derive more than one hypothesis, namely, the amino-acid poverty of this cereal, the presence of a toxic substance in it produced by a mould or some other germ, or the generation of toxins by these fungi or other organisms after being ingested with the maize. A second theory is that an exclusive and one-sided diet is at the root of the trouble; a third is that of ascribing pellagra to vitamin lack, especially the vitamin B₂. The fourth theory is the toxic one, which has assumed different forms, such as the maize toxin alluded to above, an enterotoxin generated in the intestines and hindering protein from being assimilated, or lastly a toxin generated by a pathogenic agent which may be water-borne, insect-borne or helminthic, but though each of these theories does throw some light on one aspect or other of this disease, no one of them fits its diverse features. However, in spite of prevailing ignorance as to the real cause of the malady, it seems probable that the clue to it will in time be found in the gastro-intestinal tract, and that more than one factor, exogenous and endogenous, combine to make it sprout in human soil.

The problem of pellagra as a whole is a particularly important one in Egypt, for the disease is prevalent amongst the rural population; and although reliable statistics are not available, yet one observer believes that the estimate of our incidence of 4 per cent. among the general population errs on the low side. It is known that about 4 to 10 per cent. of pellagrins develop mental symptoms, and one author has placed the proportion as high as 40 per cent. Here the question might be legitimately asked why mental symptoms

should show themselves only in that limited proportion of cases ; and the answer would appear to be that though pellagra can be taken as the exciting cause of the psychosis, it could not alone be responsible for the insanity, and that there is some other factor at work, which in our ignorance we label for the time being as predisposition. There is a parallel to this in that, luckily for many human beings, only a limited proportion of those imbibing alcohol become insane.

Before discussing these mental symptoms it is important to bear in mind the various physical manifestations of pellagra, as this enables one to understand the genesis of some of the mental symptoms as well as the insane motives at the back of many of the crimes. These physical manifestations are known to involve especially the cutaneous, digestive and nervous systems. Before the onset of the symptoms referable to one or more of these systems, there are usually varying intervals of weeks or months during which rather indefinite symptoms are in evidence, such as weakness, giddiness, depression, anorexia, constipation, headache, etc. The characteristic skin lesions are usually accompanied by burning sensations which may extend to the palms of the hands and soles of the feet. The digestive symptoms are in a large number of cases the first to appear, and they include the inflammation of the mucosa of the mouth and tongue, the latter being red and raw with denuded epithelium and the whole buccal cavity being sore and painful, often with increased salivation ; they also include gastro-intestinal disturbances such as vomiting, salty or bitter taste in the food, and a history of alternating diarrhoea and constipation. The nervous symptoms may be of a general nature and consist mainly of paraesthesiae occurring throughout the body and of muscular asthenia, especially of the legs ; but the pyramidal tracts may show transient involvement with some spasticity, exaggerated deep reflexes and Babinski's sign. There may also be encountered weakness of vision, diplopia, photophobia, and especially loss or decrease of sexual desire. It is important to note that the mental symptoms may often begin when the other prominent physical symptoms are at a standstill or have actually disappeared. In the diagnosis of these cases reliance is placed on the history together with such suggestive manifestations as the prominent parotids, the denuded or partly denuded tongue, the discoloured skin of the nose with the so-called sulphur spots, the atrophied, inelastic and often glossy skin of the back of the hands and dorsa of the feet and of the adjacent lower parts of the forearms and legs, the peculiar roughness of the skin on the trochanters and back of elbows, and lastly the often exaggerated deep reflexes.

There is nothing characteristic in the form of the mental symptoms. The most frequent manifestation is that of an intermittent delirium of the usual toxic type, that is a confusional psychosis which is usually subacute, but may sometimes be acute and accompanied by restlessness and even by a manic excitement. Another not uncommon form is that of a state of depression, which is often a reactive depression related to the patient's realization that he is suffering from a dreaded and serious physical illness. In a third small group of cases there is a mental retardation without deep depression, a sort of chronic organic reaction with memory-loss, indolence and indifference.

The accused persons sent directly from the Office of the Procureur-General for examination during the eight years and proved to be insane or mentally deficient number 1,150, thus excluding those who proved to be not insane. Out of this number 206 cases were found to be suffering from one or other of the psychoses complicating pellagra, that is a proportion of about 18 per cent. Out of these 206 cases, 56 (4 of whom females) were accused of murder or manslaughter, 15 were accused of attempted murder, one case accused of threatening in writing to kill another, 9 (4 of whom females) accused of serious assault, 20 (one female) of common assault, 3 accused of kidnapping children, 3 of destroying plants, 6 were accused of arson, 4 of sexual assault, one case (a female) of attempted suicide. Of the rest 61 (3 of whom females) were accused of theft or attempted theft, 10 (one of whom being a female) were accused of entering dwellings with the intention of committing crimes, 3 accused of forgery, 5 of escape of police supervision, 3 of vagrancy, 2 (one a female) of begging, 2 of being in possession of narcotic drugs, one each of removing official seals and of insulting the Sovereign.

The cases mentioned in the first sentence of the preceding paragraph can with advantage be grouped together as constituting crimes of violence, and they are then found to total 118 out of the 206 cases, thus constituting a proportion of just over 57 per cent. of the series. The cases of homicide alone numbered 56, and thus form 27 per cent. of insane pellagrins compared with just under 10 per cent. of murderers in the non-pellagrous, and they also form 37.5 per cent. of all insane murderers examined during the period under review.

If these cases committing crimes of violence are examined more closely it will generally be found that most of them show the form of intermittent delirium. It is easy to realize that with their mental aberration these patients are liable to suffer from certain delusions which are usually in the nature of misinterpretations of their general condition and of the unpleasant somatic and visceral sensations from which they suffer. A patient, for example, may interpret his gastro-intestinal disturbances (including the altered taste of the food, the burning sensation in the epigastrium, the occasional vomiting and the alternating diarrhoea and constipation), coupled with his general weakness, as a sure sign that his food and drink are being tampered with by the addition of noxious materials such as different kinds of poison or even menstrual blood. Another patient may, as a result of decreased or lost sexual desire, begin to be suspicious of his wife's conduct, and may ascribe such condition of his to malign influences, including sorcery, practised or instigated by his wife or her supposed paramour for their own illegitimate ends. In these two examples, the patients labouring under such delusions are liable to attack those whom they suspect in defence, not only of their honour, but of their very life.

Further, these cases of confusional psychosis generally suffer from hallucinations, usually of the visual type, but which may also be auditory. The visual hallucinations may refer to unknown persons coming towards the patient or to his home to do him harm, and he reacts to this imaginary threatening danger by attacking in self-defence any person who may be looking after him, or who chances to pass him at the height of the hallucinations. As an example,

a man seeing visions of people coming towards him with the intention of killing him, and hearing voices saying "drag him, kill him," attacked his wife and children; another patient complaining of fearful visions and alleging that he saw saints coming to kill him, murdered his own wife; while in a third case, a man in constant fear of being killed could not resist the impulse of attacking his wife and murdering her. On the other hand, the hallucinations, visual or aural or both, may be connected with a particular person who becomes the object of attack. For instance, a man saw visions of persons, including the victim, coming to shoot him, and in self-defence he shot that person dead. Another patient used to see a fearful black shadow before him and used to hear voices insulting and threatening him with death and telling him that the victim had hired an assassin to do away with him; and when he met the victim and admonished him for plotting against him, the victim is alleged to have tried to destroy the patient's only eye and so the latter stabbed him to death. These hallucinations referring to particular persons may be combined with delusions of persecution or infidelity. A man, for example, murdered his mother, alleging that she incited a cousin of his and others to kill him, that he used to see masked individuals follow him about, that his mother put poison in his food twice, and that she was misconducting herself with that same cousin. Another patient used a grubber in murdering one man and attempting to murder two others, at the same time alleging that he found the deceased with others in his own home coming to kill him and to commit adultery with his wife, and alleging also that people were blowing in his ears and mouth and moving his bed about. In a third case the accused murdered his wife, alleging that she misconducted herself with a man he saw leaving the house, that she intended to do away with him by poisoning his food with the result that he was passing worms in his stools, that he used to sleep very deeply because of the injurious substances she gave him and the sorcery she practised on him, and that on the day of the crime he experienced heartburn after partaking of the tea his wife offered him, and felt his life ebbing away and coming back; then he heard a voice telling him to kill his wife before she succeeded in finishing him off; and so he attacked and killed her with a heavy stick.

The hallucinations may be in the form of a command which the patient obeys. For instance, a man attacked another with a knife and explained that he saw terrifying shadows which ordered him to commit the crime. Another patient made an unusual attempt to murder his adult sister by pushing her into a canal while she was filling a vessel, and alleged that his wife and son were constantly whispering into his ears and ordering him to kill his victim. In the depressive form of pellagrous insanity, the motive behind the crime of violence may be identical with that met with in the ordinary melancholic, as happened in the case of a man who, after murdering his wife and two daughters, alleged that he felt his bed moving under him, that he saw fearful visions and that he heard indefinite voices, and explained that he couldn't leave the victims behind with no one to care for them after his death.

The immediate cause of the act of violence may be an illusion only, and not an hallucination, as when a female pellagrin attacked her sister-in-law with an iron bar and killed her, through mistaking her for a ferocious dog which

she alleged was snapping and growling at her, and snatching and tearing her clothes.

In the depressive form of pellagrous psychosis one expects to meet with cases of suicide and attempted suicide. The former do not come to our notice in the Department of Mental Diseases ; but during my work in the Medico-Legal Department of the Ministry of Justice, between the years 1929 and 1940, I have come across more than one instance of suicide by hanging in cases showing signs of pellagra at the autopsy and about whom I ascertained from relatives that they suffered from depression. As to cases of attempted suicide, only one case, a female who tried to poison herself with copper sulphate, was sent by the Procureur-General for mental examination and report, thus showing that no criminal proceedings are taken usually, but that the cases are certified in the ordinary way and sent to the mental hospitals.

A confusional type of case may commit or attempt suicide inadvertently by drowning through his experiencing a paraesthesia in the form of hot sensations all over the body, and so trying to relieve this condition by wading into canals. On the other hand, the paraesthesia may be in the form of cold sensations which at times lead the patient to light a fire in order to warm himself ; but such a fire may develop into a serious conflagration, thus exposing him to the charge of arson. This is the explanation in most of the six cases mentioned in this series.

One of the four crimes of sexual assault was that of an attempted rape on an adult woman, in which the offender threatened victim with a knife if his desire were not gratified, but the woman called for help and was rescued in time. In one of the cases of kidnapping children, the offender enticed the victim by buying him food, then hailed a passing taxi, and while carrying the child into it alleging that he was his own son ; the latter screamed and denied the paternity of the accused.

The crimes next in frequency in this morbid condition are those of acquisitiveness. Thefts and attempted thefts are more likely to be met with in the chronic organic type of cases, and the circumstances of the crime often bring to light the partial dementia from which the culprit is suffering. In one case, for example, the offender untied a donkey and rode off with it in sight of its owner. In another case the accused untethered a cow and led it on, walking with it leisurely and aimlessly on the public road until overtaken and caught by the owner. In a third case the offender stole some copper vessels within sight of the owner, a woman, who ran after and caught him. In a fourth case the culprit similarly stole a goat which was tethered within a short distance of its owner, and he alleged that a certain well-known saint informed him that the goat belonged to him (i.e. to the saint), and directed him to take it away.

In several other instances the things stolen were either practically worthless or were of very little use to the offender, or both. These cases of acquisitive crime number 61 in this series, and so they reach a proportion of just under 30 per cent. among the insane pellagrins.

The remaining cases comprise for the most part crimes of a petty nature such as begging, vagrancy, escape of police supervision and the possession of

drugs. Generally such crimes are likewise committed by the chronic, partially demented type of cases.

From the foregoing data it may be concluded that the form of criminality met with in the majority of insane pellagrins breaking the law is that of violence, including suicide, kidnapping and rape, and that crimes of acquisitiveness come next in the order of frequency. Bearing in mind the effects of pellagra on the skin, and especially on the digestive and nervous systems, it will not be difficult to see a remarkable and suggestive correspondence between these effects and the morbid mental manifestations which influence the conduct of the patients in such a way as to result in a preponderance of the crimes of violence. In this feature the psychoses complicating pellagra resemble to a large extent some of the other organic reaction types, namely the senile and arterio-sclerotic insanities and the alcoholic psychoses.

As to the result of the treatment of these 206 accused, 44 cases died with a proportion of 21 per cent., and 70 cases were discharged, of whom 54 recovered, with a proportion of 26 per cent., 13 cases were improved, and 3 cases were not improved and were discharged because of poor physical health. If the recovered and improved cases are taken together they will be found to make up 32.5 per cent.—that is nearly one-third—of the series. One need observe in this connection that many, if not the majority of these patients, were brought to hospital in a bad physical condition and so they could not be saved, especially during the war years when the supplies of food, clothing, medicines and other equipment were deficient. Further it must be realized that many of the cases remaining in hospital at the end of the year 1948 show improvement or apparent recovery, but that their discharge cannot up to the present be considered in view of the seriousness of their offences. It can, therefore, be legitimately supposed that with proper care and treatment the recovery rate in such cases could have been much higher than what the above figures tend to show.

STUDIES IN SCHIZOPHRENIA.

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THE diagnosis, aetiology and treatment of schizophrenia are still outstanding among the most important, complicated and least understood problems of psychiatry.

In this paper an attempt is being made to approach the diagnostic problem. The question raised is: Are there criteria to differentiate symptomatic schizophrenic syndromes from "schizophrenia," or better, "idiopathic schizophrenia?" For the purpose of the investigation certain clinical and clinical-pathological criteria have been adopted in order to find out whether there is sufficient correlation between the clinical and laboratory findings to justify the hypothesis that a differential diagnosis between the two conditions, viz. schizophrenic-reaction syndrome and "schizophrenia" (idiopathic schizophrenia) can be made. It was also hoped that clinical and prognostic subgroups might be forthcoming.

The patients investigated were all admitted to this hospital with the diagnosis or differential diagnosis of schizophrenia.

CLINICAL CRITERIA.

The clinical diagnosis of schizophrenia was made dependent on the presence to a greater or lesser degree of

1. A disturbance in conceptual thinking, such a disturbance being considered by Kraepelin, Bleuler and Kleist, and more recently stressed by A. Lewis (1946) in this country and by Hanfmann and Kasanin (1942) in U.S.A. to be one of the main characteristics of schizophrenia.

2. An inappropriate and/or inadequate emotional response, this also being considered by most writers to be characteristic of the syndrome.

3. Hallucinations.

4. Absence or diminution of empathy.*

In the early stages of the investigation, ideas of reference, non- or poorly systematized delusions, depersonalization, derealization, alteration in body image, disorders of movement and reflexes were all taken into account, but were later thought to be only of secondary importance.

* *Empathy*. According to the Oxford Dictionary: "the power of projecting one's personality into (and so fully comprehending) the object of contemplation," viz, the patient.

LABORATORY CRITERIA.

According to Kafka and Samson (1928), Neel (1933) and one of us (H. H. F., 1945), the C.S.F.s' of schizophrenics show a slight increase of total protein with a disturbance of the albumin/globulin ratio. This syndrome is absent in normals, neurotics and the true affective psychoses and was, therefore, chosen as the main laboratory characteristic.

All patients also had as a routine urine examination, bacteriology of faeces, Wassermann, blood-sugar estimation, E.S.R. and a total blood count. In a number of the later cases, serum cholesterol estimations and the modified Takata Ucko Test (T.U.T.) were carried out.

MATERIAL.

The number of patients reported on is 76, all of them females, admitted between October, 1948, and February, 1950. Sixty-four of them were examined clinically in the way to be described later. In the remaining 12 the clinical examination was less stereotyped, but the results obtained were considered sufficiently clear to warrant their inclusion in this investigation. The laboratory tests were the same in all 76 cases with the exception of blood cholesterol examination and the modified Takata Ucko Test which, as stated before, were only carried out on the later cases. Most of the cases diagnosed as schizophrenics were treated with insulin by one of us (I. C.). In 20 of these cases the C.S.F. was examined both before and after treatment. Twenty-nine of the cases were examined by our psychologist (Miss E. MacDonald). Of these, 6 were examined both before and after treatment.

TECHNIQUE AND INTERPRETATION.

General Remarks.

The first 10 cases were examined without mutual exchange of results between clinician and pathologist, following which a comparison of findings showed a high degree of correlation. The next score of patients were seen clinically by two of us (H. H. F. and I. C.), and the results obtained on the C.S.F. were read by all three of us. Hereafter, with few exceptions, all cases were investigated clinically by I. C., and the C.S.F.s' by H. H. F. and F. B. The clinical laboratory and psychological findings, again with a few exceptions, were not compared until the whole material had been collected.

Clinical Examination.

A general physical and detailed neurological examination was carried out, particular attention being given to disturbances of motility and reflexes.

Mental Examination.

A general psychiatric examination was carried out in all cases. Conceptual thinking was tested by the ability of the patient to define differences and to interpret proverbs. The tests were considered pathological not when the answers were "wrong" but when they were "paralogical." In a

number of cases the collaboration of the patients was so poor that no conclusions could be reached. In such cases the answers were tabulated as doubtful (?) in the accompanying tables. In some, the disturbance was only slight. These are tabulated as ($\pm$), and the definite positives are tabulated (+). The history of the case was obtained from the patient, her relatives and friends wherever possible. It was, however, unfortunately necessary in a considerable number of cases to rely on the somewhat scarce data given by relatives on the routine hospital history enquiry form.

The psychological tests given by Miss E. MacDonald were the Bellevue-Wechsler Scale, the Rorschach and Weigl-Goldstein-Scheerer Sorting Test.

Laboratory Tests.

Blood : Serum cholesterol.—The technique applied was that given by Pantou and Marrack (1947). We have found that the colorimetric readings are facilitated by the use of a Wratten No. 1 (red) filter. The error of the technique on serum is about ± 5 per cent. The normal values of fasting serum according to Pantou and Marrack are 160–210 mg. per cent.

M.T.U.T. (Modified Takata Ucko Test).—Reagents used: 0.36 per cent. solution of Na_2CO_3 and 0.5 per cent. HgCl_2 .

Take 10 small test tubes, put 0.9 c.c. of physiological saline into the first, and 0.5 c.c. of it into each of the other tubes. Add 0.1 c.c. of fasting serum to the first tube and make a serial dilution. Add 0.1 c.c. of the Na_2CO_3 solution to each tube, shake gently, add 0.1 c.c. of HgCl_2 to each tube and mix well immediately after the addition of the reagent to each tube. Read after 90 minutes against a dark background. The reaction is pathological if there is sedimentation in at least three of the tubes. The reaction may be checked after 18 hours and in pathological cases sedimentation will be found in at least 6 tubes. In contrast to the claims of Bauer (1947), who used the original concentration as given by Takata, this reaction (using Ucko's concentrations, 1935) is not speeded up by the exposure to very low temperatures, but is on the contrary delayed. Heat has a slightly accelerating influence though much less than when C.S.F. is being tested. The reaction is apparently normal in neurotics and emotional disorders when these are not complicated by any physical illness. The pathology of this, and similar reactions in serum (thymol, gold sol, cholesterol flocculation test), is usually ascribed by various authors to disturbances of the globulin/albumin ratio, caused by liver disease. (Literature, see Shattock, 1950). Our own investigations into the significance of this test are still in progress.

C.S.F.—Total protein, Lange reaction, M.T.R. technique and evaluation as described in a previous paper (Fleischhacker, 1945).

Cells.—Technique and evaluation as described before. It would be preferable, however, to take the C.S.F. for the cell count while the lumbar puncture is still in progress.

Pandy Test.—To 1 c.c. of saturated aqueous phenol-solution in a small test-tube add exactly 0.05 c.c. of C.S.F. Mix well by rotating gently. Reaction is read after 15 minutes against the light. With an entirely normal C.S.F. no

turbidity is seen. Turbidity is indicative of an increase of total protein, not of globulins only, as is usually stated. (Bullock and Fleischhacker, 1950.)

Nonne Test.—To 0.5 c.c. of C.S.F. are added 0.5 c.c. of saturated ammonium sulphate solution. Mix quickly. The test is read after 15 minutes against a black background. In the following tables the outcome of the Nonne Test is given in numbers, in accordance with a number of experiments carried out on mercantile pure γ -globulin, as follows :

Very faint trace	3
Faint trace	5
More than faint trace	6 etc. up to
Trace	10

It will be understood that these figures do not exactly represent the true globulin content of the C.S.F., nor is the quotient
$$\frac{\text{Nonne}}{\text{Total protein} - \text{Nonne}} =$$

$\frac{N}{TP - N}$ necessarily equal to the true globulin albumin ratio. It is interesting,

however, to mention that the $\frac{N}{TP - N}$ quotient in C.S.F.'s with normal colloidal curves was about 0.14 to 0.16, which corresponds very well with the normal globulin-albumin ratio.

The evaluation and limits of error of the techniques used as seen now on over 1,000 C.S.F.'s are still the same as described previously by one of us (H. H. F. 1945) and a certain slight overlapping of curve types cannot be avoided. This holds particularly good for the finer reading of the Lange colour changes which we find rather difficult to evaluate.

RESULTS.

The results obtained in 48 patients have been tabulated in the accompanying tables. The other 28 cases are being omitted for the following reasons :

Seven idiopathic schizophrenic patients were among the 12 whose examination was not stereotyped, but in whom the results obtained warranted their inclusion in this paper as mentioned earlier. In 21, the clinical and laboratory findings made it evident that the original diagnosis of schizophrenia could not be sustained.

The data based on our findings are in the usual type on the right side of the tables. The data given in italics contained on the left of the table were obtained from others and could not always be checked. We think, however, they are interesting enough to be published although we shall not comment on them with the exception of the puerperal cases later.

DISCUSSION.

Before the results are discussed in detail, it is necessary to say a few words on the evaluation of the findings and the techniques which were employed in the investigation.

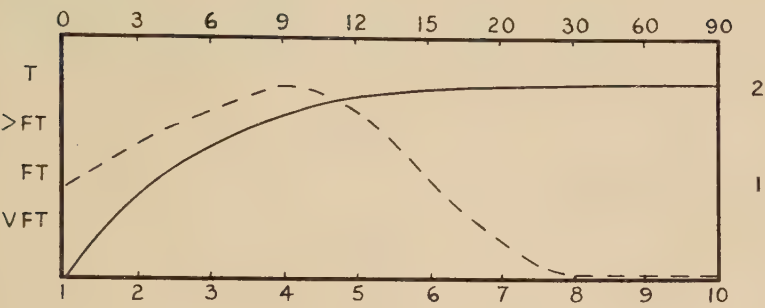


TABLE I.

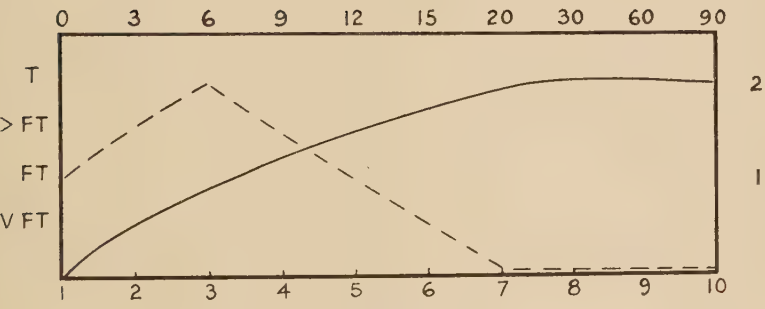


TABLE II.

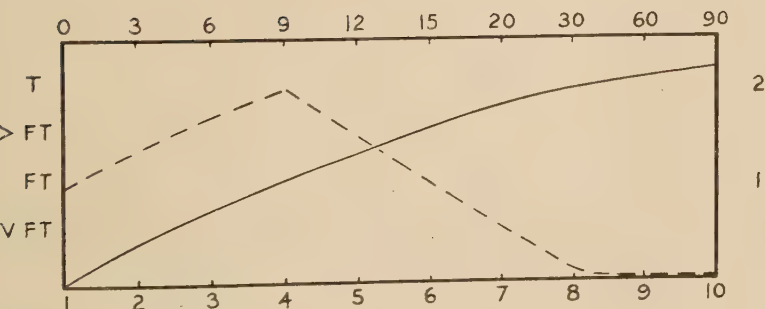


TABLE III.

Name.	Age at present admission.	Hereditary factors.	Constit. factors.	Predisposing factors.	Precipitation of first attack.	Onset of first attack.	Stay in hospital altogether in months.	Disturbance of conception thinking.
S. M. J—	17	<i>Nil known</i>	Hy ? SEV	I	I ?	Sl.	4	+
Wi—	28	<i>P+B</i>	?? BC	M	I ? M ?	Su.	2	+
Pay—	35	<i>P ?</i>	B ? V		Tr ? M ?	Su.	4½	+
Cl—	20	<i>Alc</i>	SE	IM		Sl.	8½	+
Ca—	23	<i>Alc N</i>	S ? EV	IM	I (Op)	Su.	7	+
Sp—	31		SEV	I ?		Sl.	12	+
G—	38	<i>PE</i>	SEV	Ht IM			14	+
M—	17		N (?)	I ?		Su.	38	+
Bo—	32	<i>N (P?)</i>	SE	M	I ?	Sl → Su.	16	+
V—	28		B ?				Years	+
H—	24	<i>P</i>	S Epil ?	Alc drugs			7½	+
Br—	37	<i>P ?</i>	? CEV	? Alc I ?	? floating kidney M I ? Pp ?	Sl. → Su.	16	+
Wo—	33	<i>P</i>	SE				6	+
Pa—	25	<i>P</i>	CE	I Ad		v. sl.	29	+
L—	29	<i>P</i>	? CE	M			17½	<+
McG—	27		? Ep ? C	I Alc Pp	M ?	Su	5½	+
Mo—	42	<i>Ep P Alc</i>	C (? S) EV		Ad ?	Sl	Years	+
Co—	29	<i>P</i>	? C ? BE	PA M	PA	Su	5	?
Ba—	27	<i>N</i>			M	Su	2	?
Bo—	18	<i>P ? N ?</i>	S	IM	M ?	Sl	7½	?
C—	43		C ? E	I	IM	Sl → Su	Still under treatment	?
D—	31	<i>P ?</i>	SE		M	Sl	4	+
V—	21		V	N		Sl	4	+
P—	35	<i>PB ? ?</i>	E ? S	M ?	Pp ? M ?	Sl → Su	11½	+
F—	30		Hyst ? E	I Alc	M ? E ?	Sl	12	+
S—	34	<i>Alc</i>	? C Epil	I Alc Pp	Pp ?	Sl	6	±
McE—	33				Pp	Su	4½	Confus
Hu—	30	<i>N</i>			IM ?	Su	Still under treatment	+
Ho—	35	<i>Nil</i>	? C	Pp	Pp	Su	5½	±
P—	40	<i>P</i>	B ? S ?	I Alc	Pp	Su	2½	±
B—	24	<i>P</i>	S ?	M ?	? I Pp	Su	Still under treatment	Confus
Ha, D—	31	<i>Alc</i>	N	M	I	Sl	3	+
D—	18	<i>N</i>	S	Alc		Su	2½	?
R—	20		B ?	M		Sl ?	4½	+
S—	17		S (Ep ?)	M		Sl	Still under treatment	±
Ha, B—	19	<i>Ep</i>	B ? S	Ht M			3½	?
Sa—	18	<i>P</i>	S Epil ? B ?	PA	? PA	Sl → Su	3½	+
A—	32	<i>N</i>	S	I	? I Pp ?	v. sl	2½	+
Ba—	23		N	E ?	M	Su	Still under treatment	Mut
G—	23				I	Sl → Su	4½	?
T—	30		N	Ht Pp	I	Su	1½	Confus
H—	36		N		Pp	Su	1½	"
Wh—	18		SEV (? B)	IM		Sl	6	?
B—	24	<i>P</i>	Epil E	IM	M	Su	16	±
S—	19		N ?	M Ad	H tr M	Su	3½	?
E—	28		B	M	Pp	Su	4½	Confu
W—	20	<i>P</i>			Pp	Su	6	Mut
Sp—	21	<i>Ep ?</i>	SBEV ? Epil				2	+

P = psychosis

Alc = alcoholism

N = neurosis

E = endocrine

Ep = epilepsy

S = schizoid

C = cycloid

PA = pernicious anaemia

V = vegetative

Epil = epileptoid

B = backward

Hy = hysterical

I = infection

M = mental

Type of colloidal rea

on- ion.	Hallu- cinations.	Ease of eliciting hallu- cinations.	Serum		C.S.F.					Remarks.
			M.T.U.T.	Cholest.	Total protein.	Nonne.	TP	TP-N.	Cells	
.	+	±	3	213	28	10	.55	6	3	
.	+	+	2(+1?)	260	30	10	.5	9	4	Works but still ill.
.	+	+	..	..	35	12	.52	4	..	Second admission (4/12).
.	+	+	..	..	36	12	.5	6	..	..
.	+	+	2(+1?)	336	30	10	.5	6	..	..
.	++	±	3	..	45	15	.5	3	..	Unimproved.
.	+	-	..	..	25	8	.47	4	..	Third admission (7/12). Still in hospital.
.	+	-	..	..	25	8	.47	9	..	Third admission (13/12).
.	+	±	..	..	23	7	.44	1	..	Fourth admission (4/12).
.	+	±	..	..	28	8	.4	1	..	Third admission. Still in hospital.
.	+	+	..	..	35	10	.4	3	..	Second admission (4/12).
.	+	+	..	..	28	8	.4	4	..	" " (13/12).
+	+	±	..	..	35	10	.4	8	..	..
.	+	±	..	..	30	8	.36	5	..	Second admission (24/12). Still in hospital.
.	+	±	..	..	25	6	.32	2	..	Second admission (13/12).
.	+	±	2(+1?)	230	28	8	.4	8	..	Second admission (3/12).
.	+	±	2(+1?)	..	30	8	.36	4	..	First attack 15. Since then in many hospitals. Present 3/12.
.	+	+	3(+1?)	152	30	8	.36	1	..	..
.	+	-	3	..	23	7	.35	1	..	Did not finish treatment. 1st attack few days. 2nd 7/12. Recovered without physical treatment.
.	+	-	1?	242	40	10	.3	2	..	One previous attack?
.	++	+	3	..	20	5	.3	3	..	Relapsed later.
.	+	+	4	212	25	6	.32	2	..	..
.	?	-	2(+1?)	300	33	8	.32	2	..	Second admission (9/12).
.	+	+	..	..	22	5	.3	7	..	Second attack 9/12—ovarian cyst.
.	+	+	3	..	30	7	.3	1	..	Second admission.
.	+	±	2(+1?)	156	22	5	.3	3	..	..
.	+	±	2(+1?)	225	35	8	.3	4	..	Second admission. Still under treatment.
.	+	+	..	..	38	8	.27	7	..	..
.	?	..	2	278	55	12	.28	1	..	Very def. nil neurol.
.	?	±	2	150	30	6	.25	4	..	First admission. 4/12 so far.
.	++	+	3	..	40	8	.25	3	..	..
.	++	+	4	184	25	5	.25	4	..	..
.	+	+	..	..	37	7	.23	2	..	..
.	+	-	2	290	43	8	.23	3	..	..
.	+	±	2(+1?)	217	23	4	.22	1	..	..
.	+	±	..	..	23	4	.21	2	..	..
.	+	+	2	300	30	5	.2	2	..	Very slow onset over years.
.	+	+	3	213	30	5	.2	6	..	..
.	+	±	..	..	25	4	.2	8	..	..
.	++	..	3	225	33	5	.18	2	..	..
.	?	..	2	290	33	5	.18	4	..	..
.	?	-	..	..	45	5	.12	2	..	..
.	+	-	1	288	45	5	.12	6	..	An organic case (Diss. scler.?).
.	?	-	2	252	30	4	.15	3	..	..
.	+	+	2(+2?)	288	45	6	.15	2	..	..
.	?	-	..	..	45	6	.17	2	..	..
.	+	-	..	..	25	5	.25	10	..	? Schiz., but very outspoken. Reflex disturbances. Slightly blurred discs.

t = head trauma
 d = adolescence
 = trauma
 o = operation
 p = puerperium
 s = sudden
 = slow.

+ distinct
 ± little outspoken
 ? doubtful
 + strong
 - inadequate
 ± inadequate and inappropriate

It must be stressed that the authors of this paper fully realize that none of the clinical or laboratory findings are in any way *specific*, but that rather the combination of clinical and laboratory findings elicited here are *characteristic* of "schizophrenia."

Paralogical disturbances of thinking and of speech are very often found in patients recovering from organic sensory aphasia. This, of course, was known to Kraepelin and many other writers. Inadequacy and inappropriateness of affect, hallucinations and all the other signs seen in schizophrenia may equally be found in the organic psychoses. Similarly a disturbance in the albumin/globulin ratio in the C.S.F. together with a slight increase of total protein, of cells and pathological deviation of the colloidal reactions may be found in treated G.P.I., occasionally in epileptics, in disseminated sclerosis, in brain tumours, also occasionally following head injuries and very rarely in senile disorders. It is our contention, however, that a clinical picture consisting of a disturbance of thought, a disturbance of emotion, of empathy and most commonly with hallucinations, plus the changes found in the C.S.F. in the absence of other organic disease are the characteristic picture of "schizophrenia."

There are, of course, possibilities of subjective error, partly due to the varying degree of collaboration obtained from the patients which render the interpretation of tests difficult, but these can be overcome by practice. With regard to the paralogias, one of us (H. H. F., 1930) has shown how the margin of error can be narrowed. Similar objections may be raised in respect to the evaluation of the laboratory results. A few points have been dealt with above under Technique. Also, in a previous paper (1945) it was shown that the total C.S.F. syndrome has to be taken into account in order to reach a correct decision. Accordingly, in the majority of the C.S.F.'s examined, the various test results should have been and actually were concordant. In a few others, some of the results, with the techniques used, appeared to contradict each other, usually in that the strength of the Lange reaction corresponded roughly to the increase in total protein while the turbidities of the Nonne and Pandy and M.T.R. were too slight. This discordance has so far commonly been found to occur in patients with raised blood cholesterol.

On the whole, the collaboration between clinician, psychologist and pathologist has worked well and has been of mutual benefit and what is more important, has proved to be of value to our patients.

According to the combined investigation and using our criteria, the patients could be divided into three groups:

A. The 21 cases in which the diagnosis of schizophrenia could not be sustained were as follows:

Involutional melancholia, 2.

Reactive psychoses in high-grade mental defectives, 5.

Toxic infective psychoses and organic disorders of the brain, 14.

Only in two of these cases, one brain tumour and one presenile dementia, might the C.S.F. syndrome have fitted into the type of milder schizophrenia. In the rest of these cases, the C.S.F.'s were normal, or what is usually acknowledged as "organic."

B. The 42 tabulated schizophrenics. There are two subgroups :

1. As represented in Tables I and II.
2. As represented in Table III.

Sub-group 1.—In the material demonstrated in Tables I and II the clinical signs were on the whole very marked, a severe thought disturbance, shallow, inappropriate, inadequate affect, loss of empathy and hallucinations about which the patient was very reticent. The C.S.F. showed a very strong increase of globulins and the M.T.R. rose to its peak within 15–20 minutes or less. There are, however, differences in the intensity of clinical and biochemical reactions between Tables I and II which may be significant in that for the patients in Table II the length of stay in hospital is less and the percentage of remissions is appreciably greater than in Table I.

Sub-group 2.—The patients in Table III presented a difference in accentuation. These patients are more obviously hallucinated, their emotional response is usually inappropriate but has greater depth, empathy is present and, finally, the thought disorder is usually difficult to elicit. (Tabulating the results makes it possibly difficult to convey adequately an idea of this difference between the sub-groups.) The C.S.F. shows, on the whole, that the increase in total protein is due to a relatively greater increase than in Sub-group 1, in the albumin fraction. The M.T.R. accordingly rises more slowly, taking from 60 to at least 90 minutes to reach its peak.

All patients of this sub-group are first admissions, consequently having a better prognosis but, unless treated, a number might have drifted into chronicity.

C. In this group, consisting of 6 patients, we were unable to make an adequate diagnosis as they did not fit either clinically or clinico-pathologically into the schizophrenic group. It is interesting to note that on the whole, the T.P. in the C.S.F.'s of these patients is higher than those of Group B. The globulins are only slightly increased and the M.T.R. ascends slowly in a straight line.

Miscellaneous Remarks.

Twenty-two serum cholesterol examinations and 26 M.T.U.T.'s only were carried out. It is interesting to note that abnormal cholesterol values were found in patients with some endocrine disturbance (dysplastic adolescents, puerperals, climacterics, two ovarian cysts). In these cases the M.T.U.T. was often normal. It was also normal in one puerperal case with a subnormal cholesterol.

The findings of the C.S.F.'s before and after insulin treatment are, as it has been described by other writers, only slightly different. They appear to run more or less parallel with the clinical course. Three cases may be worth while mentioning: In one of these three cases, while the pathological and psychological laboratories showed a deterioration of the patient's condition after treatment, the patient was very much improved clinically. Another case, a puerperal who showed clinical improvement after insulin while the C.S.F.

was worse, relapsed soon after her discharge. A third patient whose C.S.F. was worse after treatment, remained in hospital for more than a year.

These simple techniques that can be used in any hospital or laboratory have helped us to sort out 21 cases from the 76 loosely diagnosed as schizophrenics, thus enabling us to establish their true diagnoses with obvious benefit to these patients. Beyond this diagnostic value these findings have apparently a prognostic significance, as is shown by the length of stay in hospital in the tables, those in Table III having a better prognosis.

Will these methods enable us to differentiate further any schizophrenic sub-groups?

The small groups of puerperal cases may allow us to approach this problem. There were 10 patients in groups B and C in whom the psychosis began very soon after delivery.

The principal possible connections between puerperium and psychotic reaction in these cases are as follows:

(1) The psychosis is a true puerperal psychosis of schizophrenic colouring.

(2) The psychosis is a true "schizophrenia" precipitated by the puerperium.

The material is tabulated as follows:

TABLE V.—*Puerperal Psychoses.*

Name.	Disturbance of conceptual thinking.	Emotional reaction.	Hallucinations.	C.S.F.				Serum	
				Total protein.	N TP-N	Cells 3	Reaction type.	Cholesterol.	M.T.
E—	Confused	±	+	45	15	2	D	288	(+2)
W—	Mute	±	+	45	17	3	D		
H—	Confused	+	+	33	18	4	D	290	
P—	±	±	?	55	28	1	D?	278	
S—	±	+	++	27	3	4	D?		
A—	+	±	+	30	2	2	D?	300	
B—	+	+	?	30	25	4	C	150	
Ho—	+	+	±	38	27	8	C		
McE—	Confused	± → +	+	22	3	3	C	156	
Pe—	+	—	?	33	32	8	C		

Although it was clear in these 10 cases that the puerperium had a definite connection with the psychosis, it was not very clear in any of these patients whether a psychosis had existed before delivery, which means that we have to rely on the facts of the clinical and laboratory examinations. According to the school of Kleist, schizophrenia should not be diagnosed unless there is an outspoken disturbance of thought with paralogias. From this point of view it will be noticed that thought disorder was not very outspoken in any of the five patients in the upper half of the table, in three of these the C.S.F. results were discordant (D), three of the cholesterols high + no M.T.U.T. was definitely pathologic. In the lower half of the table four patients showed definite conceptual disturbance and in three of these the C.S.F. findings were concordant (C), and only one cholesterol was high.

In three C.S.F.'s no decision as to con- or discordance could be made.

SUMMARY AND CONCLUSIONS.

1. An attempt has been made by close co-operation between clinical and laboratory workers and, in a number of cases, the psychologist, to correlate and classify their findings in cases at first loosely diagnosed as "schizophrenia" and so to define more clearly the basic clinical and clinico-pathological signs of "idiopathic schizophrenia" and to eliminate schizophrenic-reaction syndromes.

2. The case material consists of 76 cases admitted to this hospital between October, 1948, and February, 1950.

3. The clinical diagnosis of "idiopathic schizophrenia" was made dependent on the presence to a greater or lesser degree of:

(a) A disturbance of conceptual thinking.

(b) A disturbance of affect.

(c) Hallucinations.

(d) Absence or diminution of empathy.

The laboratory diagnosis was based on the finding of an increase in total protein with a disturbance of the albumin globulin ratio in the C.S.F.

The cases fell into the following groups and sub-groups:

A. In 21 cases the diagnosis of schizophrenia could not be sustained. The patients were diagnosed as suffering from involutional melancholia, psychotic reactions in feeble-minded people, toxic and infectious states or organic diseases of the brain.

B. Forty-nine cases were "idiopathic schizophrenics." Forty-two of these were tabulated and fell into two groups.

Sub-group I—Tables I and II.

This sub-group was characterized by a severe disturbance of conceptual thinking, shallow inappropriate affect, absence of empathy and hallucinations that were difficult to elicit. The C.S.F. showed a very strong increase of globulins and the M.T.R. rose to its peak within 15–20 minutes. Prognosis on the whole was bad.

Sub-group II—Table III.

These patients were more obviously hallucinated, their emotional response was usually inappropriate but had greater depth. Empathy was present and finally, the thought disorder was difficult to elicit. The C.S.F. showed, on the whole, that the increase in total protein was due to a greater increase in the albumin fraction than in the cases of sub-group I. The M.T.R. accordingly rose more slowly, taking from 60 to at least 90 minutes to reach its peak. Prognosis on the whole was good.

C. A group of 6 unclassified patients.

CONCLUSIONS.

The clinical and clinico-pathological criteria used in this investigation proved of definite diagnostic value in the differentiation of schizophrenic-

reaction-syndromes from idiopathic schizophrenia ; they also revealed the existence of clinical and prognostic sub-groups amongst idiopathic schizophrenics.

Our thanks are due to Miss E. MacDonald for her kind collaboration.

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THE TREATMENT OF DEPRESSION BY DINITRILE SUCCINATE.

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CASPERSSON, Hyden and Hartelius, in a series of researches at the Caroline Institute, Stockholm, found that (a) nerve cells subjected to heavy stimulation become depleted of nucleoprotein; (b) nitrile compounds administered to the experimental animal hasten regeneration of this nucleoprotein; (c) biopsy specimens of the prefrontal cortex of psychotics removed at leucotomy show a reduction of cellular protein when compared with healthy subjects killed in accidents; (d) nitrile compounds have a beneficial stimulating action in psychotics and sometimes a permanent curative effect. The substance which they used, malononitrile, was toxic, liable to produce severe reactions and only usable with safety if, after the injection, the patient was kept under observation and given sodium thiosulphate at the first sign of trouble. Meyer and Meyer (1949) have adversely criticized their methods and conclusions.

Mackinnon, Hoch, Cammer and Waelsch (1949) published the results of a clinical trial of malononitrile in nine psychotic patients, and obtained unpleasant toxic reactions even although they administered the antidote as a routine. They concluded from their chiefly schizophrenic material that the therapeutic action of malononitrile is "essentially negative." Hartelius (1950) explains their lack of success as due to errors in technique.

Delay, Deniker, Sizaret and Laine (1949), after a brief trial, abandoned malononitrile on account of its excessive toxicity and after some experimentation introduced the succinate as the nitrile compound of choice. They report good results in depressive reactions with or without accompanying anxiety or hysterical manifestations. Dinitrile succinate is now marketed in sterile ampoules ready for intravenous injection under the proprietary name "Suxil."

I have now treated 30 patients with Suxil, the drug being administered by intravenous injection, one 2 c.c. ampoule, or 0.1 gm. in the first injection and two ampoules, or 0.2 gm. in subsequent injections. Injections were given three times a week, at 2-day intervals. In no case were toxic phenomena observed, and the administration of the antidote was never necessary. At first six injections were regarded as a complete course, but later, following representations by the manufacturers, this was extended to 12.

The accompanying table summarizes the case material, procedure and results.

Cases 1 to 8 were severe depressions of psychotic intensity treated in hospital. Case 9 was also an in-patient, but was much milder, and it would, in fact, have been possible to treat him as an out-patient. Cases 10 to 23 were

No.	Age.	Sex.	Summary of history.	Clinical features.	Number of injections.	Outcome.
1	33	F.	Puerperal onset. Fluctuating depression for 2½ years	Depressed and complaining of lack of feeling and difficulty in concentrating	6	No improvement. E.C.T. given.
2	37	F.	4 weeks' depression with loss of weight and ideas of unworthiness	Agitated, tearful and self-reproachful	12	No improvement. E.C.T. given.
3	35	F.	Puerperal onset of depression 4 months ago. Suicidal attempt prior to admission	Tearful, retarded and self-depreciatory	3	Became worse. Course interrupted and E.C.T. given.
4	40	F.	Depression with depersonalization and fits of weeping for five months	Tense, depressed and complaining bitterly of feelings of depersonalization	6	No improvement. E.C.T. given.
5	41	F.	Increasing depression for 18 months	Delusions of guilt. Actively suicidal	3	Became worse. Course interrupted and given E.C.T.
6	59	F.	Slowly increasing depression with hypochondriacal fears and feelings of guilt for 6 months	Depressed, tearful and self-reproachful	6	No improvement. E.C.T. given.
7	28	F.	Puerperal onset of depression and insomnia 6 months ago	Depressed and tearful, with feelings of guilt and hypochondriacal complaints	6	" "
8	29	F.	Two previous depressive attacks with 1 suicidal attempt. Puerperal onset of present attack 16 months ago	Depressed, tearful, self-reproachful and actively suicidal	5	No improvement. Discharged herself against advice and had to be admitted to an observation ward.
9	33	M.	6 weeks' depression with insomnia and difficulty in concentrating	Anxious, tremulous, depressed and obsessed by various fears	3	Began to improve rapidly after it was decided to give him the treatment and before the first injection. Recovered.
10	35	F.	6 months' gradually increasing depression with obsessional ruminations	Depressed, with a variety of anxiety symptoms and morbid fears	6	In middle of course made suicidal attempt and had to be admitted. At end of course was back in same state as at beginning, but 2 months later was again severely depressed and actively suicidal.
11	43	F.	One previous depression treated by 3 months in hospital. Recurrence of depression for 3 weeks	Depressed and complaining of beating sensations in her head and irritability	6	No improvement. Failed to attend hospital after last injection and committed suicide a month later.

No.	Age.	Sex.	Summary of history.	Clinical features.	Number of injections.	Outcome.
12	42	F.	Two previous attacks of depression, neither necessitating hospitalization. Depressed for 2 months influenza	Mild anxiety and depression with lack of energy and obsessional thoughts	6	No improvement. Ceased to attend the hospital after 1 month from the end of treatment.
13	48	F.	One previous short depression, necessitating discharge from A.I.S. Depressed for 6 weeks following mild environmental difficulties	Mildly depressed and complaining of restlessness, insomnia and sensations of heat	6	Very transient improvement, followed by severe psychosis with delusions of guilt and impending disaster, necessitating hospitalization and E.C.T.
14	45	F.	One previous depression treated in hospital. Depressed for 3 months	Mild depression with self-reproachful ideas and complaints of headache and difficulty in concentrating	12	No substantial improvement. Depressed and still complaining of symptoms.
15	27	F.	Slow onset of anxiety and depression over past 3 years, possibly connected with marital difficulties	Tense, anxious, irritable and depressed	6	No substantial improvement. Psychotherapy arranged.
16	31	F.	Eight months' depression	Mildly depressed, tense and anxious	6	Transient improvement of short duration. A month after end of treatment back in same condition as at start.
17	48	F.	Mild anxiety state following operation 14 years ago. Slow onset of depression and anxiety during past 18 months	Mildly depressed and irritable. Complaining of lack of energy and fatiguability	12	No substantial improvement. Symptoms unchanged.
18	54	F.	Depression for 1 year since death of son in accident	Depressed and complaining of insomnia	6	Recovered.
19	39	F.	Attacks of weeping followed by collapse for past 5 weeks	Tense, anxious and depressed	6	"
20	29	M.	Three months' severe anxiety attacks and depression	Anxious, depressed and full of hypochondriacal fears	12	No improvement. Psychotherapy arranged.
21	27	F.	Occasional mild depressions for past 7 years	Mildly depressed and complaining of irritability and fits of weeping	4	No improvement. Injections stopped because of smallness of veins.

No.	Age.	Sex.	Summary of history.	Clinical features.	Number of injections.	Outcome.
22	47	F.	Three weeks' depression precipitated by conflict over love affair with a younger man	Mildly depressed, intermittently tearful and complaining of insomnia and anorexia	12	Worse. Admission advised.
23	51	M.	Slow onset of depression for 12 months apparently connected with increasing demands made by his wife	Anxious and depressed, with a tendency to self-reproachful ideas	12	Worse. Admitted to hospital.
24	24	M.	Dull, dependent, inadequate history of one previous breakdown under stress	Mild depression with complaints of boredom and lack of interest	4	No improvement. Ceased to attend after fourth injection.
25	28	F.	Exacerbation of depression for 3 months on a basis of a chronic neurotic illness with mixed anxiety and hysterical features of 7 years' standing	Depressed. Tearful at times. Anxiety symptoms such as difficulty in breathing	6	No improvement. Psychotherapy arranged.
26	49	F.	Inadequate and emotionally unstable with several mild depressive illnesses during the past 15 years	Tremulous, intermittently tearful, apologetic and self-deprecating	12	Moderate improvement. More cheerful but unduly fatiguable and lacking in energy.
27	37	F.	Emotionally unstable and easily upset. Fits of depression and irritability getting more violent for past 7 years	Tense, anxious, depressed and tearful	12	Recovered.
28	45	M.	Discharged from Army because of neurosis 21 years ago and never really free from neurotic symptoms since. One severe previous depression with hospital treatment	Mildly depressed and complaining of headache and insomnia	12	No improvement. Symptoms unchanged. Remains unfit for work.
29	39	M.	Timid, retiring, unenterprising. Chronic depression for six years	Mildly depressed and complaining of headache	6	No improvement. Symptoms unchanged.
30	35	M.	Dull, timid, submissive, and solitary. Chronic mild depression for past 2 years	Sad and listless. Complaints of headache and insomnia	12	Ditto.

mild uncomplicated depressions in previously healthy people, Cases 24 to 30 were exacerbations of depression in people with a long history of neurotic symptoms or gross personality disorder.

It will be seen that only four recovered during the time that they were having injections and only two more made any noticeable degree of improvement. None of the really severely depressed patients showed the slightest amelioration of their condition. The group as a whole did far from well during the period under review. The four patients who recovered all had an excellent prognosis for spontaneous recovery, as had most of the patients in this series, although in Case 27 this was only a short term one.

Some of these patients are suggestible and apt to be impressed by a dramatic form of treatment such as intravenous injections, asking for more and stressing its subjective value to them, although objectively their state remains unchanged. Minor fluctuations in the day to day condition of mildly depressed patients are the rule. These considerations and the high spontaneous remission rate make the assessment of the efficacy of therapy peculiarly difficult. I was unable to satisfy myself that the drug as administered had any specific therapeutic action.

SUMMARY.

Thirty cases of depression were treated with dinitrile succinate in the form of the proprietary preparation "Suxil." This is safe, easy to administer, and quite free from toxic effects in the doses recommended. No clear evidence of its therapeutic value was obtained.

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A CASE OF ASPIRIN POISONING.

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FROM time to time accounts have appeared of recoveries and of deaths following the ingestion of large doses of aspirin. A further case is here reported.

CASE HISTORY.

The patient is a married man, aged 44, who was admitted to hospital for the fourth time on 22.iii.1948, having previously been in Severalls Mental Hospital in June, 1943, from October, 1943 to March, 1947, and from November, 1947 to January, 1948. He suffers from paraphrenia, and shortly before this suicidal attempt was noted as believing that he had the capacity to receive secret information from M.I.5. He had, on previous occasions, spoken of being persecuted over the radio by Whitehall, and had numerous other bizarre delusions. For some years he has expressed the view that he, and other mental patients, should be subjected to euthanasia. On 16.v.1950 he went on leave and stayed with friends. For the first two days of the leave he appeared quite well. On the morning of 18th May, however, he decided to end his life, and during the day he bought twelve bottles of aspirin at three different shops. Eight small bottles contained, according to the shop-keeper, 25 tablets of 5 gr., but according to the patient, who says that he counted them, only 22. The four larger bottles contained about 100 tablets of 5 gr. in each. The number of tablets in each bottle, and in one case the actual sale was confirmed by the local police.

The patient spent the afternoon with his wife. In retrospect she thought that he seemed depressed. He complained to her that he was suffering from abdominal pain and that his complaints were ignored at the hospital or treated as delusions. He had in fact been investigated for this complaint and a barium meal showed a deformed duodenal cap but no active ulceration. At 6.45 p.m. after leaving his wife, the patient crushed the aspirin, and swallowed, he estimates $\frac{2}{3}$ of the total—i.e. about 2,500 gr. aspirin. Knowing that he would be reported missing he then secreted himself in a boat lying on the beach of a nearby coast resort. He noticed a man working on another boat a little way along the beach and then went to sleep.

At 11 p.m. he was awakened by a knocking on the side of the boat. This he took to be the man he had previously seen, now working on the boat in which he was hiding. He remained quiet for about 10 minutes, as he still did not wish to be discovered. The continual tapping, however, became too much for him, and he peered over the side of the boat to find that the tide had come in and that the cause of the noise was in fact the sea around the boat. He was now acutely distressed and realised that he might be beyond help as he was cut off. He became frightened, shouted for help, and vomited—just over four hours after he had taken the aspirin. He was rescued by the police about 150 yards from the shore some 40 minutes later and was eventually taken to Southend General Hospital where he again vomited copiously and where his stomach was washed out at about 1.30 a.m. The washings were strongly positive by the ferric chloride test for salicylates.

The patient was transferred to Runwell Hospital at 11 a.m. the next day—i.e. about 16 hours after taking the aspirin and on admission was hyperpnoeic, cyanosed, and pyrexial (101°. 114.36). He vomited a coffee grounds fluid and was unable to retain fluids by mouth. He admitted to some pain in the lumbar region but only on being pressed as to the existence of any discomfort. He was slightly deaf but denied tinnitus. Mentally he was unimpaired and gave a full account of his actions. His mood was, however, one of euphoria. Though he appeared acutely

uncomfortable he said that he felt very well and that he thought that the aspirin had done him a lot of good.

During the following 12 hours, 2 pints 5 per cent. dextrose and 1 pint N-saline were given intravenously, and a further 2 pints 5 per cent. dextrose with 2 hourly doses of 4 grams sodium bicarbonate were administered rectally. After 24 hours fluids were retained by mouth. 20 c.c. cerebrospinal fluid were removed under pressure and the patient claimed subjective relief from the procedure. His euphoria has, however, been commented upon. Fluids were forced for two days and on the third day he was able to retain a light diet. A penicillin screen was provided for 5 days. The temperature settled in 24 hours and none of the subsequent rises in the following 16 days was greater than 99°.

Laboratory investigations showed occult blood positive 4 days after admission but negative on subsequent testing. No salicylates were detected in the urine after 3 days. Urea concentration and thymol turbidity tests were within normal limits on the 5th and 14th day respectively. BSR remained 9 mm.60 minutes on the 11th day.

Some two months after the incident the patient remains cheerful and says that his failure to commit suicide must be because this is not intended by God. He has numerous ideas as to what he will do in the future but changes each plan before he has done very much about it. He draws what he says are humorous cartoons and writes pseudo-philosophical material which he hopes to publish. He is resentful of any discussion of his previously expressed ideas of euthanasia and says that this simply replaces them in his mind. He admits that he is able to pick up messages from other people's minds but would only speak of this in private as he is aware that others are sceptical of his abilities. He does not expect the writer to believe him—indeed he remarked that on a previous escape he had told Scotland Yard about it and had been laughed at. He explains this phenomenon as analogous to religious experience and says that perhaps one day the writer will "experience" and then "believe." He complains of the environment of the Mental Hospital which he regards as responsible for a lot of swearing that he "picks up." He calls this phenomenon "ego conflict" and says that it is the attempt of one person to impose himself on another. He says that he no longer has any abdominal pain.

DISCUSSION.

The clinical features of this case are broadly as described by Hopkins (1945) except that this patient showed a rise in temperature as previously reported by Charters (1944), Neale (1936) and Dyke (1935) and since reported by Krasnoff and Bernstein (1947). This patient also continued to show some evening rises during the subsequent 16 days. Fulton (1949) notes that the focal centre of "the complex integration which controls body temperature is located in the hypothalamus." The therapeutic antipyretic action of aspirin and the sub-normal temperatures in some cases of poisoning are said by Goodman and Gilman (1941) to be due to stimulation of the anterior hypothalamic nuclei through which diaphoresis and peripheral vasomotor activity are invoked. Pyrexia in toxic doses of aspirin is not commented upon, but may be due either to stimulation of the posterior hypothalamic nuclei (and Masserman (1937) has shown that both anterior and posterior nuclei are affected by such agents) or by inactivation of the anterior nuclei. Fulton notes that experimental lesions in the latter region are followed by hyperthermia. Abolition of function often follows excitation with increased intensity of the excitant in the CNS.

A second difference in this case was the presence of euphoria. Mental changes mentioned by Hopkins are drowsiness, hallucinations and delusions. Goodman and Gilman mention the occurrence of the symptoms of "cerebral

excitation." These are known as "salicylic jag" and are said to be "restlessness, incoherent speech, excitement and occasionally mania, delirium and hallucinations." Similar states it should be noted may accompany hyperthermia in lesions of the anterior hypothalamus and the euphoric mood in this case may be presumptive evidence of localization of the effect of the drug to the anterior hypothalamic nuclei. It is also noteworthy that the visceral afferents traverse the anterior hypothalamus and then project through the thalamus to the orbito-frontal cortex. The division of this projection is the rationale for the performance of frontal lobotomy in intractable visceral pain. It will be remembered that our patient did not complain of abdominal pain after his suicidal attempt.

The presence of cyanosis is commented upon by Krasnoff and Bernstein. Gross pathological changes in aspirin poisoning are said to occur in the brain, kidney and liver. Function tests and clinical examination in this and other cases indicate a return to previous functional levels.

The largest dose of aspirin previously reported in a case of poisoning was 1,500 gr. by Evans (1938).

SUMMARY.

1. A case of poisoning by ingestion of 2,500 gr. of aspirin with subsequent survival is reported.

2. It is suggested that the symptomatology, including mood change, may be accounted for by inactivation of the anterior hypothalamic nucleus.

Thanks are due to Southend General Hospital for lending the patient's records; to Southend Police for the detailed reports referred to, and to Dr. S. L. Last, Consulting Psychiatrist, Runwell Hospital, for permission to publish this report.

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Part II.—Reviews.

The Group Approach to Leadership-testing. By HENRY HARRIS.
London: Routledge & Kegan Paul, 1949. Pp. x + 288. Price 21s.

This is a lengthy and comprehensive story of the selection of officers in the Army. It is the view of one observer who is enthusiastic, but it does show the advance that was made after a scientific research had been undertaken to select leaders for the Army.

It is a difficult book to read because of the language used by the author, and because the technique of selection is given in great detail.

It will be of great interest to those who are working in the psychological field of selection, and to psychologists and psychiatrists now working on projection test techniques.

It is an excellent account of officer selection methods during the past war.
S. W. GILLMAN.

The Infancy of Speech and the Speech of Infancy. By LEOPOLD STEIN.
London: Methuen, 1949. Pp. xiv + 209. Price 21s.

The evolution of speech is a problem beset with difficulties, for its beginnings must be a matter of conjecture, and our knowledge of ancient languages teaches us that they were more complex than modern ones, thus apparently adding another obstacle to our understanding. In this book the author has invoked the law of biogenesis, seeking to interpret phylogeny as an analogue of ontogeny. He is influenced by the psychoanalysts, and considers speech to be partly an emotional phenomenon developed from sucking, through clicks such as are still found in some savage languages, and reiterated sounds, of which civilized man retains examples, the whole being altered by onomatopoeia and the similar occurrences described by Piaget.

A wide view is taken, and the book begins with elementary geological, archaeological and anatomical considerations, but these are too scrappy, e.g. the work of Barclay is ignored in describing the mechanism of the throat. There is too much physical anthropology for such a small book, and this is not all well evaluated, too much stress being laid on *Pithecanthropus erectus*, which is now believed merely to have been an ape.

The English is generally good, though not always idiomatic, but there are a few mistakes, such as the misuse of the word "interpolate."

This is a brave attempt, on an important and obscure subject, which is unfortunately spoiled by being too speculative.
E. S. STERN.

Grundlagen der Psychiatrie (Fundamentals of Psychiatry). By K. LEONHARD, Professor of Psychiatry and Neurology in the University of Frankfurt-on-Main. Stuttgart: F. Enke Verlag, 1948 Pp. 246.

This book, dedicated to K. Kleist, gives a clear account of psychiatry as taught at the Frankfurt University Clinic. Apart from certain nosological concepts concerning the schizophrenic reaction types, which are characteristic

of Kleist's teaching, the book reflects the general trends of present-day German psychiatry. Neuroses are dealt with under psychopathies, which are regarded as condensations or exaggerations of innate personality traits, or as attenuated psychoses. Psychodynamic concepts are mentioned only casually. Psychotherapy is recommended as helpful in the psychopathies, but no serious attempt is made to introduce the reader into its basic principles. In the chapters dealing with the psychoses the author is on firmer ground. Following Kleist, he describes a variety of "Randpsychosen" (i.e. border-line psychoses) which show features of both the major psychotic reaction types, though not belonging to either group. Among the "cycloid psychoses" he distinguishes one which is characterized by swinging between paranoid anxiety and ecstatic elation, the confusional psychosis with perplexity, and the motility psychosis of Kleist and Funfgeld. In the border-line psychoses convulsant treatment is recommended, also in some cases of mania, while in the chapter on melancholia this type of therapy is not mentioned. In the classification of the schizophrenias the author follows Kleist fairly closely. Leonhard's "affective paraphrenia," which often responds well to convulsant therapy, is a useful clinical concept. Involucional depression and involucional paranoia (Kleist) are dealt with under mental disorders of endocrine origin. In dealing with the diagnosis of epilepsy the author does not mention the E.E.G. He does not refer to vitamin treatment in cases of mental disorder due to alcoholism. Psychiatric sequelae following head injury are, without qualification, regarded as part of a neurological syndrome caused by abnormal lability of the cerebro-vascular system caused by trauma. Acquaintance with the researches of British and American workers will no doubt cause the author to modify his views on this and a few other subjects.

These critical comments should not detract from the value of the book, which fulfils its purpose as an introduction to clinical psychiatry with special reference to the psychoses admirably.

E. STENGEL.

Ursprung und Vorgeschichte der Sprache (Origin and Pre-history of Language). By G. RÉVÉSZ. Bern: A. Franke Verlag, 1948. Pp. 279.

The author, who is professor of psychology in the University of Amsterdam, and is well known for his contributions to the psychology of language and music, considers that the original goal of speech was the initiation of mental contact. He subjects the various theories of the origin of language (biological, anthropological, philosophical) to a critical survey. Having found none of them satisfactory he presents his "contact theory," from which he evolves the thesis of the triad of language functions—the imperative, the indicative and the interrogative. Even the most primitive form of language served each of these functions. The genetic primacy of the verb, and of the imperative and indicative in particular, is inherent in this theory. The author denies that there is a phase in the development of language in which speech is purely egocentric, as assumed by Piaget for a period of childhood. The development of language as a means of communication is examined from its most primitive to its most complex forms. The contact theory is not fundamentally new. Its basic principles were stated by Plato, and it is contained implicitly in de Saussure's and Bühler's concepts on the function of language. But the author justly claims that none of his predecessors has made this thesis the basis of a comprehensive theory of both the development and the functions of language. Professor Révész does not think that the study of speech disorders resulting from brain lesions can contribute materially to the problems discussed in his book. However this may be, his work is of considerable interest for the student of aphasia, and for the psychiatrist concerned with speech disorders occurring in conditions which seriously affect human relations such as schizophrenia.

E. STENGEL.

Ausdruckssprache der Seele (*The Language of the Expressions*). By Professor K. LEONHARD. Saulgau (Württ.): Karl F. Haug. 1949. Pp. 507.

The author examines mimics, gestures and inarticulate ejaculations as means of human intercommunication. He gives a comprehensive phenomenological analysis of the various mimical expressions and their combinations, classifying them according to the groups of muscles involved and the psychological events they reflect. He attempts a similar grouping for gestures and ejaculations, and finally discusses the functional relationship between these three groups of emotional reactions. Leonhard disagrees with Darwin's view that expressions are no more than residues of purposive movements. He regards the relationship between expressive and voluntary movements as inessential for the theory of expressions. He sees in the expressions an emotional language in its own rights, which though phylogenetically older than verbal language, has not fallen into disuse with the development of speech. The language of the expressions, both in its executive and receptive aspects, develops as a biological function which is not taught and learned like speech. It is, in the author's view, under the control of the autonomous nervous system.

The book contains 275 pictures, which demonstrate the scope as well as the limitations of photography in this field. Professor Leonhard's book is a valuable contribution to the elucidation of a subject which is as fascinating as it is elusive.

E. STENGEL.

Delinquency and Human Nature. By H. D. STOTT. Carnegie United Kingdom Trust, 1950. Pp. 460.

Under the auspices of the Carnegie United Kingdom Trustees, Mr. Stott, during four years, studied 102 lads in an approved school who were received from the metropolis, provincial town and country areas. He discussed the cases with the house-staff, and collected all the available information about the previous history of each individual, as well as about his home and its emotional atmosphere. He had also formal interviews with each lad, and frequent contacts with the majority in his evening club and own home and garden. He set out to ascertain the element in "delinquent breakdown" which gives point to law-breaking, and indicates how apparently irrelevant delinquent conduct may appear to be relevant on analysis. The material is presented in a series of case-histories grouped according to fairly standard types of emotional environment and consequential reactions. An outsize tabular statistical summary of the situation as seen by the author is appended, and blank copies of this chart are said to be available for use in psychological clinics and by other research workers. Mr. Stott states that he has discarded the modern method of comparing his results with those from a non-delinquent group of lads because of the "probable inconclusiveness of the control group technique."

Although this is a painstaking contribution to the subject, it deals—as the author recognizes—with only a small number of delinquents. Unhappily he refers to "affection choking neurosis," "affectional neurosis," and "Peter Pan neurosis"; to "affectional neurotic" and "achievement neurotic." He alludes to imbecility as a "regression neurosis," and describes some lads as dual personalities although no phase of their conduct is ignorant of the rest. Without further evidence he describes a lad with an insecure family situation and some hypersensitivity to rebuff as a case of paranoia, and believes that he could produce a schizophrenic or manic-depressive personality if given the child from birth. It is rather surprising to find that Mr. Stott refers to himself on page 170 as a psychiatrist, although it is true that he makes no claim on the title-page of the book to any medical qualification. Clinical psychiatrists,

however, are entitled to believe that loose terminology impedes accurate study and refuse to work in blinkers.

W. NORWOOD EAST.

Freud or Jung. By EDWARD GLOVER. George Allen & Unwin, 1950. Pp. 207.

Here is a detailed, clear, closely reasoned critique of Jung's analytical psychology, one that will convince the would-be eclectic of the incompatibility of Freud and Jung, *provided* the reader accepts all Freud as correct. The author of course maintains that the Freudian views must be accepted wholly or not at all (though many might disagree), and on this basis he gives a masterly exposition of the weaknesses of the Jungian system.

He points out how Freudian terms are used by Jung without attaching to them the "true" Freudian meaning, and how Jung's Personal Unconscious is the equivalent of Freud's Preconscious. Again, Jung describes repression as initiated by considerations of a conscious order so that he does not recognize true repression and is merely speaking of suppression. The concept of conflict appears to Jung as an opposition between constitution (dressed up as the collective unconscious) and volitional aspects of consciousness, and he fails to recognize any latent content in either dream or neurotic symptom.

While he looks upon the libido as a unitary urge (primarily non-sexual), he nevertheless points to it as the source of all energy, but at the same time regards his archetypes as activated by a separate energy of their own—indeed, as capable of spontaneously creating themselves. These archetypes—to continue Glover's argument—appear as influences too wise, too purposive and adapted to be really primitive unconscious factors at all; rather are they in the nature of traditions.

From these and other criticisms, from the fact that there is no room in the Jungian system for any theory of child development, and from the inconsistent elaboration of a "faculty" psychology, Glover concludes that Jung's psychology is a "conscious" psychology. Consequently there can be no point of contact between Jung's views and Freud's, and therefore no conflict between them; it is merely a question of accepting or rejecting the whole of Freud's psychology of the unconscious.

While one may not agree with the author's basic premise—complete allegiance to Freud—one can but enjoy the extreme clarity and incisiveness with which this book presents the many difficulties and inconsistencies of Jung's writings. It was high time that a clear Freudian critique of Jung should be written, and this the author has done admirably.

J. E. NICOLE.

Autobiography. By W. STEKEL. Liveright Publishing Corporation, 1950. Pp. 293.

This is an interesting book, pleasantly written, but it disappoints in that it keeps on such a superficial plane; one gleans all too little of the author's life beyond the overt observable circumstances of his varied career. One can, however, appreciate how his particular technique of psychotherapy owes much to his well developed and often wise intuition, and how he was himself involved, both actively and passively, in all the human cross-currents of suspicion and rivalry that permeated the early psycho-analytical groups.

J. E. NICOLE.

Ask the Children. By Lt.-Col. FORD THOMPSON. Cassell & Co., 1950. Pp. 288.

This entertaining little book is in the main an exposition of a method for disciplining the child by means of a system agreed between child and parent (or teacher) of accepting a given code of conduct and the punishments that

departure from the code entails. The punishments are, however, mostly those for the child's transgressions; no mention is made of any retribution in connection with the adult's departures from this agreed code. This theme could well have been developed in a comparatively few pages, and one regrets that so much of the book should have been devoted to haphazard excursions into the realm of psychology, the value of which is small, while their tendency to misinform is great.

No notice is taken of the modern views of child development, and the discussion of emotion and mental mechanisms is completely superficial and inadequate. One might instance the banal conclusion advanced that "our subconscious (!) memories contain more than is normally accessible to consciousness." What are we to make of the definition of the sex instinct as "the desire to create babies," or of the statement that "sublimation consists in taking the pro out of procreation"? No regard is paid to standard authorities on the subject, and indeed the only ones listed in the index are Akhenaton, Confucius, Gautama Buddha, Muller, Pavlov and Watson.

It is this inconsequential stringing together of a hotch-potch of superficial and inaccurate psychological dicta that caused us above to label the book as entertaining.

J. E. NICOLE.

The Sexual Perversions and Abnormalities. By CLIFFORD ALLEN. 2nd. Edition. Oxford Medical Publications, 1949. Pp. 346.

This book will prove of use in that it gives a fairly full account of the various forms of sex expression met with in psychiatric practice. The author's somewhat biased attitude can be gleaned from his very choice of title: what many writers would term sex variants he prefers to call perversions and abnormalities. He stresses treatment in all instances, and leaves little room for the recognition of any forms of sex behaviour that do *not* require treatment, except for the so-called "normal" relations as defined by rigidly conventional standards. His expectation of a "cure" in every case is surely very sanguine, while his views on the incidence and nature of these abnormalities often differ from those of eminent authorities on the subject. It will be interesting to see whether in another twenty years' time the author's outlook will not have changed from what it is to-day.

J. E. NICOLE.

A Practical Handbook of Psychiatry for Students and Nurses. By LOUIS MINSKI. Wm. Heinemann, Ltd. Price 6s.

The aim of Dr. Minski's book is to be an introduction to psychiatry for students, nurses, occupational therapists, social workers, and for all interested in the subject. It is not a complete text-book, and as the author himself says, "the subject matter is presented in a somewhat concentrated manner."

In this second edition minor alterations have been made to the text, and new methods of treatment, introduced since the first edition, are described.

Throughout the book psychiatry is considered as a branch of medicine, and the emphasis is on the close relationship of mind and body. Psychiatry, as Dr. Minski points out, is also a social as well as a medical science; it "has a wide scope and must be approached from various angles." The book starts with the development of the individual followed by short chapters on child psychiatry, and the aetiology of mental illness. A section on general symptomatology is followed by chapters on the various mental disorders. The remainder consists of sections on nursing and general management, specialized forms of treatment, psychotherapy, occupational therapy, rehabilitation, and a final chapter on the legal aspects of psychiatry.

The chapter on nursing and general management is necessarily brief in a book of this nature but is clear and helpful. A desirable addition to this chapter

would have been a few paragraphs devoted to the psychological aspects of the management of patients, especially on their first admission to a mental hospital. It cannot be too highly stressed to nurses commencing their training in psychiatric nursing, that though the patients are suffering from mental illnesses they are still humans, and need encouragement and help in regaining their self-confidence. The majority of admissions these days are voluntary patients, and are distressed and apprehensive on arriving in hospital. The nurses should be told how large a part they themselves can play in producing the right attitude to hospitalization and treatment. One would like to see a few remarks on the necessity of taking an interest in their families, worries, etc., of being strictly truthful with them, and of explaining when possible the reasons for treatments, for the removal of valuables, closed doors, and all the other restrictions that are so strange and irritating to the patients. The description of treatments in this section are clear but very impersonal, and no mention is made of these points. In the paragraph on refusal of food, badly cooked or unattractively served dishes might be given as another of the causes.

In the section on specialized forms of treatment no mention is made of fever treatment by physical methods as an alternative to malaria therapy for general paralysis. Dr. Minski gives the mortality rate for insulin coma therapy as about 1 per cent. Surely it is usually considered as nearer 0.1 per cent?

This is a concise and easily readable book, and the subject matter is presented in such a way that it cannot fail to interest its readers, and to stimulate more intensive and detailed studies after this first introduction to the subject. It might go a long way to clearing up some of the misconceptions and prejudices about psychiatry if it was given to all medical and nursing students to read during their general training.

I. B. HICKSON, S.R.N., S.M.N., D.N. Lond.

Part III.—Bibliography and Epitome.*

ACTA NEUROL. PSYCHIAT. BELG.

VOL. L.		MAY, 1950.
The General and Neurological Semiology of Intracranial Aneurysms: I.		
<i>Ketelaer, Ch.-J.</i>		217
	JUNE.	
General and Neurological Semiology of Intracranial Aneurysms: II. <i>Ketelaer, Ch.-J.</i>		279
Chemical Analysis of Mineral Elements in Cerebral Calcification in Sturge-Weber's Disease. <i>Wachsmuth, N., and Lowenthal, A.</i>		305
Anatomo-clinical Observations of Toxoplasmosis. <i>Betz et al.</i>		314

ACTA NEUR., PSYCHIAT. SUPPL.

		1950.
Psycho-infantilism		No. 61
Comments on Neurological Diagnosis by Puncture. <i>Antoni, N.</i>		No. 59
Cephalalgia with Special Reference to Histamine Headache. <i>Dalsgaard-Nielsen, T.</i>		17
Sphygmographic Studies of the Mechanism of Headache. <i>Gulberg, B.</i>		45
Some Therapeutic Results in Cases of Migraine. <i>Dalsgaard-Nielsen, T.</i>		59
On the Essential Nature of Hydro- and Syringomyelia, Myelocoele, Encephalocoele, etc. <i>Wangel, G.</i>		65
A New Therapy in Myasthenia Gravis. <i>Störtebecker, T. P.</i>		88
Investigations on Myotonia Congenita, etc. <i>Sürola, M.</i>		122
The Grasp Reflex and the Instinctive Grasp Reaction. <i>Seyffarth, H.</i>		136
Allergic or Pseudo-allergic Neuritis. <i>Ottesen, E., and Dalsgaard-Nielsen, T.</i>		146
Experience of Cases of Serious Brain Injury. <i>Hilbom, E.</i>		159
On the Treatment of Organic Lesions in the C.N.S. with Prostigmine and Eserine. <i>Parland, O.</i>		166
		178

AM. IM.

VOL. VI.		1949.
The Cosmological Aspect of Freud's Theory of Instincts. <i>Sherba, R.</i>		157
Freud's Scientific Beginnings. <i>Bernfeld, S.</i>		163
A Short Note on Empedocles and Freud. <i>Arkin, A. M.</i>		195
Did Freud Really Advocate a "Hands-off" Policy towards Artistic Creativity? <i>Berglv, E.</i>		205
A Biographical Comment on Freud's Dual Instinct Theory. <i>Ekstein, R.</i>		211
Freud and Literary Theory. <i>Wormhoudt, A.</i>		217

AM. J. MENT. DEF.

VOL. LV.		JULY, 1950.
A Workshop in Developing Lessons for Retarded Adolescents in a Program of Occupational Education. <i>Borreca, F., et al.</i>		23
A Study of Social Position of Mentally-handicapped Children in the Regular Grades. <i>Johnson, G. O.</i>		60
Statistical Survey of a Group of Institutionalized Cerebral Palsy Patients. <i>Gauger, A. B.</i>		90

* A number of abstracts in this section are reproduced from *Chemical Abstracts* and *Psychological Abstracts*. To the Editors of these Journals we extend our grateful thanks.

Statistical Aspects of Mental Deficiency with Congenital Cerebral Spastic Infantile Paralyzes. <i>Malzberg, B.</i>	99
Abnormal Findings on the Spine of Mongoloids. <i>Mautner, H.</i>	105
Nursing Therapy in Mental Deficiency. <i>McClure, C.</i>	108
The Effect of Glutamic Acid Feeding on Cognitive Abilities of Institution-Mental Defectives. <i>McCulloch, T. L.</i>	117
Performance of Retarded Individuals on Stanford-Binet and Wechsler-Bellevue Intelligence Scales. <i>Stacey, C. L., and Levin, J.</i>	123
Social and Emotional Problems of the Mentally Retarded Child. <i>Walker, G. H.</i>	132
A Study of the Personal Characteristics Desirable for the Vocational Success of the Mentally Deficient. <i>Michal-Smith, H.</i>	139
The Employable of High-grade Mental Defectives. <i>Tizard, J., and O'Connor, N.</i>	144

AM. J. ORTHOPSYCHIAT.

VOL. XX.	JULY, 1950.
Social Patterns in Orthopsychiatry. <i>McBee, M.</i>	445
Individual Therapy and Collective Reform. <i>Brinton, C.</i>	453
Values and the Psychiatrist. <i>Ginsberg, S. W.</i>	466
The Genetics of Differences in Psychosomatic Patterns in Childhood. <i>Sontag, L. W.</i>	479
Observations on Asthmatic Children. <i>Harris, I. D., et al.</i>	490
A Study of Hostility in Allergic Children. <i>Miller, H., and Baruch, D. W.</i>	506
Psychiatric Study of Children with Pulmonary Tuberculosis. <i>Dubo, S.</i>	520
School Mental Hygiene. <i>Hertzmann, J.</i>	529
Signposts for Social Psychiatry from the International Congress on Mental Health. <i>Ridenour, N.</i>	545
A Study of Miners in Relation to the Accident Problem: I. <i>Hirschberg, J. C., et al.</i>	552
The Psychiatrist in Caricature. <i>Redlich, F. C.</i>	560
Desirable Standards and Criteria for Accreditation of Training Clinics in Child Psychiatry. <i>Gardner, G. E.</i>	572
The Geosign Test. <i>Hackett, W. R.</i>	578
Genetic Aspects of Some Rorschach Factors. <i>Rabin, A. I., and Beck, S. J.</i>	595
The Mosaic Test. <i>Frankl, A. W.</i>	600
Reactions of Mothers to Pregnancy and Adjustment of Offspring in Infancy. <i>Wallin, P., and Riley, R. P.</i>	616
Psychiatric Therapy in Infancy. <i>Spitz, R. A.</i>	623
Eating and Working. <i>Bartemeier, L. H.</i>	634
The Psychotherapeutic Impasse. <i>Whitaker, C. A., et al.</i>	641

AM. J. PSYCHIAT.

VOL. CVII.	JULY, 1950.
Beyond the Patient. <i>Stevenson, G. S.</i>	I
The Use of Antabuse in Chronic Alcoholics. <i>Barrera, S. E., et al.</i>	8
A Study of the Results in Hospital Treatment of Alcoholism in Males. <i>Prout, C. T., et al.</i>	14
*The E.E.G. in Korsakoff Syndrome. <i>Gorman, W. F., et al.</i>	20
An E.E.G. and Clinical Study of Children with Primary Behavior Disorders. <i>Cattell, J. P., and Pacella, B. L.</i>	25
*Square Waves (B.S.T.) versus Sine Waves in E.C.T. <i>Bayles, S., et al.</i>	34
High Fidelity Recording of Psychotherapeutic Interviews. <i>Redlich, F. C., et al.</i>	42
Psychiatric Aspects of Cord Injury. <i>Nagler, B.</i>	49
*Analysis of Temporal Factors in Manic-depressive Psychosis, with Particular Reference to the Effect of Shock Therapy. <i>Oltman, J. E., and Friedman, S.</i>	57

The Electroencephalogram in Korsakoff Syndrome.

1. The electroencephalograms were examined of 21 patients with a history of severe alcoholism and a confabulatory amnesic psychosis, nystagmus and peripheral neuropathy.

2. The electroencephalographic findings were not characteristic of this syndrome : 17 showed abnormal tracings, and there were 4 normal records. Of the abnormal records 15 contained a predominance of moderately slow activity, and 9 of these 15 showed a lesser degree of fast activity. Two individuals presented focal abnormalities that corresponded well with clinical and pneumoencephalographic evidence for cerebral trauma.

3. There was no direct correlation between the degree of the electroencephalographic abnormality and the degree and duration of the psychosis, the nystagmus or the neuropathy.

4. The four patients who had convulsions also had cranio-cerebral injuries.

(Authors' abstr.)

Square Waves (B.S.T.) versus Sine Waves in Electroconvulsive Therapy.

1. A report on the authors' first year's experience with the Liberson-Offner Brief Stimulus technique for electro-convulsive therapy is presented in comparison with conventional sine wave technique.

2. Clinical study shows these methods to be equally effective in so far as observable improvement is concerned.

3. Electroencephalographic studies indicate the brief stimulus therapy method produces a significant reduction in post-treatment electrocortical disturbance. The evidence at present does not permit a statement of the presence or absence of irreversible brain changes.

4. It is postulated that the electrocortical disturbance is of no favourable or adverse significance in the clinical course. The amount of confusion produced seems similarly to be of little or no clinical significance.

5. The authors have observed a greater incidence of fractures of the spine following treatment with brief stimulus therapy, and conclude from this and from direct observation that the physical violence of the seizures is no different with either method.

6. As an incidental observation it seems that electro-convulsive therapy is of value in the treatment of schizophrenics, and that this value does not depend upon the presence of depression in the schizophrenic symptomatology.

7. Finally, the authors do not find any overwhelming evidence to indicate preference for either type of stimulator in clinical practice, although certain aspects of either method may be more or less objectionable in relation to the immediate feelings of given patients.

(Authors' abstr.)

Analysis of Temporal Factors in Manic-depressive Psychosis, with Particular Reference to the Effect of Shock Therapy.

A review of temporal factors in 262 cases of manic-depressive psychosis indicates that the onset of illness is somewhat later in men than in women. Neither the age of onset, i.e. before or after 40, nor the type of predominant phase of illness, i.e. manic or depressive episodes, exerts a significant influence on the frequency of attacks or the length of remissions. The duration of hospitalization in untreated patients is essentially similar for manic and depressive episodes. Shock therapy effects a marked reduction in the duration of hospitalization of depressed patients ; the effect is slightly greater for first hospitalizations than for later ones. There is less prominent shortening of length of hospitalization by shock therapy during manic episodes. In each instance the proportion of protracted hospitalizations is definitely diminished. The effect of shock therapy on length of remissions is not entirely clarified. However, it may be stated that shock therapy diminishes the incidence of rehospitalization within one year of discharge, irrespective of the numerical order of the illness. The question as to whether or not the incidence of lengthy remissions is affected by shock therapy can be answered only after another decade or more of observation has elapsed.

(Authors' abstr.)

AUGUST.

Diagnosis and Prophylaxis in Psychiatry at Home and Abroad.	Rees, J. R.	81
Old and New Information about Electroshock.	Cerletti, U.	87
*Further Experiences of the Use of Malononitrile in the Treatment of Mental Illnesses.	Hartelius, H.	95
Psychiatry and the Ancillary Services.	Hann, P.	102

Verbal Hallucinations as Automatic Speech. Gould, L. N.	110
*Transorbital Lobotomy in Institutional Practice. Jones, C. H., and Shanklin, J. G.	120
The Frequency of Drug Psychoses. Levin, M.	128
Encephalitis as a Psychiatric Problem. Lindsay, D. S.	131

Further Experiences of the Use of Malononitrile in the Treatment of Mental Illnesses.

1. The present paper offers some comments on the preliminary report by MacKinnon, Hoch, Cammer and Waelsch on the treatment of mental illnesses with malononitrile. The forementioned authors reported nine cases and stated that they obtained negative results. Their negative results are correlated by the writer to the short duration of the individual treatments.

To this extent the results of MacKinnon *et al.* confirm the experience of the writer (Hyden and Hartelius, 1948). No therapeutic effects have been observed to follow an m-treatment with a duration of only 15 minutes. In order to obtain results, emphasis is placed here—as in the earlier report (1948)—on the importance of a sufficiently long duration of the individual treatment.

2. The writer also reports on a more recent series of 40 patients with recorded katamnoses.

3. Each patient was given an average of 1,250 mg. The average individual dose was 2.4 mg./kg. body weight. The average duration of the m-stage was 48 minutes. The average number of treatments in a course was eight.

4. The mental effect is in the nature of a stimulation that becomes evident within 24–28 hours of each treatment.

5. The results are collocated. They are markedly positive in 23 cases, relatively positive in 9, and negative in 8. The results are lasting in 22 cases and transient in 10.

6. The relation between malononitrile treatment and E.C.T. and other forms of therapy is discussed. Twenty-six patients received E.C.T. before malononitrile treatment, with varying results. Contra-indications to E.C.T. were present in 23 cases.

7. The clinical value of the method is due mainly to the positive results, its freedom from risks, and the fact that it is less limited than E.C.T. by contra-indications.
(Author's abstr.)

Transorbital Lobotomy in Institutional Practice.

As the description of the technique indicates, very little time is required to perform the operation. When Freeman first introduced the procedure to Western State Hospital in August, 1947, 13 patients were operated upon in a single afternoon. In October, 1948, he demonstrated the later-developed movement at the 5-cm. mark on five patients in slightly more than one hour.

The simplicity of transorbital lobotomy becomes quite evident in light of the authors' successful operation of 74 cases independently following a preceptorship that consisted of the operation of three patients, each under Freeman's supervision.

As no fatalities or complications resulted it appears that transorbital lobotomy is safer than the standard neurosurgical procedures. The complication of post-operative convulsive seizures has not been observed.

In giving transorbital lobotomy an institutional trial the authors' goals were to determine if the operation could be of any practical aid in dealing with intractable mental illnesses and to assist in the refinement of case selection. On the basis of personal bedside experience with Freeman's 18 patients and with the authors' 74 it was found that the procedure could be valuable in certain chronic patients. If the disability is minor, although requiring chronic hospitalization, and if the physical methods of treatment have nearly produced a recovery on frequent occasions, transorbital lobotomy may succeed in spite of the illness being of long standing. Also on the basis of study of the 92 cases it appears that the value of the operation in rapidly progressing schizophrenic illnesses of more than a year's duration is somewhat limited. However, it often demonstrates a capacity of the patient to respond to psychosurgery, and indicates a favorable prognosis to a more extensive operation at a later date. Transorbital lobotomy was performed on several patients early in the series on whom a more extensive procedure would be recommended now if psychosurgery were being considered for the first time.

It may be concluded that transorbital lobotomy is simple, safe and inexpensive. In particular it is to be recommended for institutional use. (Authors' abstr.)

SEPTEMBER.

Some Reflections on War and Peace. <i>Wright, Q.</i>	161
Why State Hospital Superintendents Fail. <i>Perkins, C. T.</i>	170
The Clinical Director looks at the Hospital Superintendent. <i>Duval, A. M.</i>	173
What the Nurse Looks for in the Administrator. <i>Fitzsimmons, L. W.</i>	176
Cerebral Palsy. <i>Fay, T.</i>	180
Clinical Report on the Use of Dimethyl Ether of D-tubocurarine Iodide in E.C.T. <i>Ulett, G. A., et al.</i>	184
An Institutional Program for Committed Sex Deviants. <i>Cruvant, B. A., et al.</i>	190
Group Therapy in Sexual Maladjustment. <i>Stone, A., and Levine, L.</i>	195
Strategic Conditions in the Psychotherapy of Persons with Schizophrenia. <i>Betz, B.</i>	203
Complications of Acute Catatonic Excitement. <i>Aronson, M. J., and Thompson, S. V.</i>	216
A Follow-up Study of Motor Withdrawal Reaction to Heat Discomfort in Patients Before and After Frontal Lobotomy. <i>Chapman, W. P., et al.</i>	221

AM. J. PSYCHOL.

VOL. LXII.	1949.
The Precedence Effect in Sound Localization. <i>Wallach, H., et al.</i>	315
Temporal Factors in Figural After-effects. <i>Hammer, E. R.</i>	337
A Reformulation of the Fechner Law in Terms of Adaptation-level Applied to Rating-scale Data. <i>Michels, W. C., and Helson, H.</i>	355
The Influence of Isolation on the Learning of Surrounding Materials. <i>Smith, M. H., jun., and Stearns, E. G.</i>	369
An Experimental Examination of the Non-Selective Principle of Association of Drive-stimuli. <i>Kendler, H. H.</i>	382
Some Phenomena Attendant on Long Fixation. <i>Monks, M. R.</i>	392
A Preliminary Study of the Crocker-Henderson Odor-classification System. <i>Ross, S., and Harriman, A. E.</i>	399
Specification of Sound-pressure Levels. <i>Pollack, I.</i>	412
An Improved Color Mixer. <i>Cohen, J.</i>	418
An Apparatus for the Study of Form-preference. <i>Rashkis, H. A., and Kahn, L.</i>	421
Beats from Combining a Unit Frequency with a Mistuned Multiple. <i>Meyer, M. F.</i>	424
The Relation of Body Morphology to Galvanic Skin Conductance and Response. <i>Lacey, O. L., et al.</i>	430
Design of Equipment and Optimal Human Operation. <i>Helson, H.</i>	473
The Discrimination of Visual Number. <i>Kaufman, E. L., et al.</i>	498
Simultaneous Chromatic Contrast in Normal and Abnormal Color-Vision. <i>Chapanis, A.</i>	526
The Moon Illusion and Similar Auditory Phenomena. <i>von Békésy, G.</i>	540
The Effect of Brightness on Figural After-effect. <i>Freeburne, C. M., and Hamilton, C. E.</i>	567
A Decade-type Electronic Interval-timer. <i>Hunter, T. A., and Brown, J. S.</i>	570
A High-gain Low-noise Neuro-biological Amplifier. <i>Gilmer, B. von H., et al.</i>	576
Operant Conditioning of a Vegetative Human Organism. <i>Fuller, P. R.</i>	587
Co-efficients of Precision in the Method of Constant Stimuli. <i>Fernberger, S. W.</i>	591

AM. J. PSYCHOTHER.

VOL. IV.	JULY, 1950.
Therapy of the Weak Ego. <i>Bychowski, G.</i>	407
The Problem of Medical and Lay Psychotherapy. <i>Galdston, I.</i>	419
Why Patients Discontinue Treatment in a Mental Hygiene Clinic. <i>Dengrove, E., and Kutash, S. B.</i>	457

The Clinical Significance of the Mosaic and the Rorschach Methods.	<i>Zucker, L.</i>	473
Bipolarity in Diagnosis through Art.	<i>Zierer, E.</i>	488

AM. PRACTIT.

VOL. I.		JULY, 1950.
Bacterial Meningitis following Lumbar Puncture.	<i>Keefer, C. S.</i>	679
Emergency Psychotherapy in General Practice.	<i>Hulse, W. C., and Lowinger, L.</i>	706
Clinical Management of Acute Intoxication in the Chronic Alcoholic.	<i>Kieve, R.</i>	743
The Psychogenic Aspect of Dermatologic Therapy.	<i>Cleveland, D. E. H.</i>	767
Chemical Structure of Substances Effective in Treatment of Parkinsonism.	<i>Gair, D. S., and Ducey, J.</i>	773
Present Status of E.C.T.	<i>Kalinowsky, L. B.</i>	782

AUGUST.

Metastatic Brain Abscess.	<i>Cohn, T. D., et al.</i>	792
The Depressed Patient.	<i>Grahn, H. V.</i>	795
Psychiatric Therapy in Cardiovascular Disease.	<i>Morris, H. H., and Smith, L. H.</i>	823

SEPTEMBER.

Psychotherapy in General Practice.	<i>Hulse, W. C., and Lowinger, L.</i>	926
A Psychobiologic Approach to the Problem of Obesity.	<i>Jonas, A. D.</i>	933
Psychotherapy in Psychosomatic Medicine.	<i>Saul, L. J., and Fischer, H. K.</i>	938
Review of the Headache Problem.	<i>Friedman, A. P.</i>	948

ANN. MED.-PSYCHOL.

VOL. CVIII.		JULY, 1950.
The Rorschach Test.	<i>Minkowska, F.</i>	145
The Arnold-Chiari Deformity.	<i>Gros, C., and Sabraing, J.</i>	190

ARCH. NEUR. PSYCHIAT.

VOL. LXIII.		JUNE, 1950.
*Hepatolenticular Degeneration.	<i>Herz, E., and Drew, A. L., jun.</i>	843
*Athetosis and the Basal Ganglia.	<i>Carpenter, M. B.</i>	875
Ophthalmoplegic Migraine.	<i>Patrikios, J. S.</i>	902
Effects of Inanition on the C.N.S.	<i>Liu, C.-N. and Windle, W. F.</i>	918
*The Vomiting Center.	<i>Wang, W. C., and Borison, H. L.</i>	928
Spontaneous Thrombosis of the Carotid Arteries in the Neck.	<i>Webster, J. E., et al.</i>	942
Pain and Contracture in Poliomyelitis.	<i>Guyton, A. C., and Reeder, R. C.</i>	954
*Oligodendrogliomas.	<i>Earnest, F., et al.</i>	964

NEW YORK NEUROLOGICAL SOCIETY, ETC.

Chorionepithelioma: Single Metastasis in the Infundibulum.	<i>Perry, G. F.</i>	993
Spongioneuroblastoma.	<i>Ambler, J. J.</i>	993
Cerebral Changes Associated with Generalized Thrombocytic Thrombosis.	<i>Green, M. A., and Rosenthal, S.</i>	994
Clinicopathologic Study of Five Fatalities Resulting from Exposure to Simulated High Altitudes in Decompression Chambers.	<i>Davison, C., and Haymaker, W.</i>	998
Massive Hemorrhage in Brain Tumors.	<i>Gross, S. W., and Bender, M. B.</i>	1001

PHILADELPHIA NEUROLOGICAL SOCIETY.

Treatment of Unbearable Pain by Mesencephalothalamotomy.	<i>Spiegel, E. A., and Wycis, H. T.</i>	1003
--	---	------

- Demonstration of a Case of Facial Pain Relieved by Mesencephalothalamotomy.
 Wycis, H. T., et al. 1004
 Neural Toxicity from the Sulfonamides. Gammon, G. D., and Schoenbach,
 E. B. 1010

Hepatolenticular Degeneration: Analysis of Dyskinetic Phenomena; Relation of Degree of Hepatic Damage to Course of the Disease; Nervous Disorders in Ordinary Disease of the Liver.

Six cases of hepatolenticular degeneration were studied; in an additional case the characteristic motor phenomena were present, but the diagnosis was doubtful.

The significant features of the dyskinetic motor phenomena are described, with motion picture analysis. Spontaneous abnormal involuntary movements may be absent or, if present, may show the characteristics of regular alternating tremor or choreatic, athetotic or dystonic movements. During the maintenance of positions, disco-ordination ("static intentional ataxia") may be present, or alternating tremor, previously observed "at rest," may be increased in intensity. Both factors may interfere with the performance of fast active movements.

The mechanisms involved in the production of these specific dyskinetic phenomena, in particular the effect of cerebellar disturbances, are discussed.

The clinical findings and laboratory data related to damage to the liver are reported in each case. Neither clinical nor laboratory evidence of impairment of hepatic function was found in three cases; laboratory tests gave abnormal results in four cases. A positive reaction in the cephalin flocculation test and reduction of serum albumin were the most frequent pathologic findings.

The duration of the disease in this series was correlated with the severity of the damage to the liver. A rather prolonged course, over many years, was observed in some cases in which evidence of hepatic damage was missing or was not pronounced. A rapid progressive course of only one and a half years was found in other cases with obvious symptoms and signs of hepatic impairment.

The pathologic changes in the liver could be studied in three cases. In one case the chronic process of cirrhosis of the liver with predominant connective-tissue proliferation was observed, whereas in two cases a rather acute process with necrotic phenomena resembling subacute yellow atrophy was superimposed on the chronic process.

The association of neurologic disorders with "ordinary acquired" hepatic disease in man and the occurrence of peculiar symptoms with cirrhosis of the liver in domestic animals are evaluated, and the differentiation of the symptoms and pathologic picture of these conditions from the typical picture of hepatolenticular degeneration are outlined. (Authors' abstr.)

Athetosis and the Basal Ganglia: Review of the Literature and Study of Forty-two Cases.

A review of the literature disclosed the reports of 42 cases of hemiathetosis, double athetosis and double athetosis with torsion dystonia with adequate clinical descriptions and reports of pathologic changes. Analysis of these cases led to the following conclusions:

1. Athetosis is a pattern of involuntary dyskinesia which can be distinguished from chorea, and is characterized by increases and decreases of tone in irregular sequence in antagonistic muscle groups and slow involuntary movements involving chiefly, but not exclusively, the distal appendicular musculature such that vermicular activity results.

2. Hemiathetosis usually develops after hemiparesis, or in association with it, as a consequence of necrotizing cerebrovascular lesions, which destroy part of the internal capsule and striatum on the side opposite that of the activity. In some cases hemiathetosis may result from cerebrovascular lesions located in the diencephalic course of the brachium conjunctivum and in the region of the subthalamic nucleus, contralateral to the activity.

3. Hemiathetoid activity may be present despite secondary degeneration of the corticospinal tract on the affected side, but cases are rare.

4. Double athetosis usually manifests itself in early infancy, and in almost half the cases (46 per cent.) a history of trauma at birth is recorded. Bilateral

paresis and spasticity, particularly of the lower extremities, are present in almost one-half the cases of double athetosis. Retarded speech development and/or dysarthria are present in a high proportion (80 per cent.) of the cases, and more than half (58 per cent.) of the patients are mentally defective.

5. Double athetosis is most frequently a consequence of bilateral status marmoratus (*état marbré*) of the striatum, but also appears as a result of bilateral necrotizing cerebrovascular lesions in the striatum.

6. Double athetosis may appear as a result of bilateral status dysmyelinisatus of the globus pallidus or of localized destruction in the globus pallidus bilaterally.

7. Status marmoratus of the striatum does not inevitably result in double athetosis, although such instances are rare.

8. Double athetosis may appear without demonstrable pathologic change in the striatum or globus pallidus, but such cases are rare.

9. Double athetosis with torsion dystonia usually manifests itself in infancy, but may appear later in life. The incidence of paresis, spasticity, speech disturbances and mental impairment is the same as that in double athetosis without torsion dystonia.

10. Double athetosis with torsion dystonia is a consequence of the same pathologic changes in the same structures as those reported in cases of double athetosis without torsion dystonia.

Adequate clinical descriptions and pathologic study will continue to be of value in elucidating the genesis and nature of these phenomena, particularly when supplemented with cinematographic records. (Author's abstr.)

The Vomiting Center: A Critical Experimental Analysis.

The location of the vomiting center in the brain stem was demonstrated by two basic methods:

1. Electrical stimulation of a certain region of the medulla elicited vomiting. This reactive region corresponds to the dorsolateral border of the lateral reticular formation, including the tractus solitarius and its nucleus.

2. Destruction of the same general region produced a preparation which was permanently refractory to high doses of apomorphine and copper sulfate. On the other hand, animals with bilateral ablation of the dorsal nucleus of the vagus, while also permanently refractory to apomorphine, responded reflexly to small doses of copper sulfate. The dorsal sensory nucleus of the vagus, on which apomorphine acts, thus constitutes one of the afferent influences on the emetic neuron complex.

Therefore, the central mechanism of vomiting *per se* must reside in the dorso-lateral border of the lateral reticular formation, and not in the superficial structures designated by Hatcher and Weiss. This center is in the midst of other loci, the activities of which constitute the complex physiologic pattern of vomiting.

(Authors' abstr.)

Oligodendrogliomas: A Review of Two Hundred Cases.

From this study of 200 cases of oligodendroglioma, certain features tending to define this tumor entity were outstanding. The growth appeared to be one primarily of the fourth and fifth decades, and affected the sexes about equally. It was most commonly located in the cerebral hemispheres as a subcortical infiltrating neoplasm, but in rare instances practically any other part of the brain was involved. The life span of the tumor was long, being estimated as from eight to fourteen years. Deposition of calcium was a rather characteristic phenomenon of this tumor, regardless of the age of the patient or the location of the tumor, and appeared relatively early in the development of the neoplasm, probably between the second and the third year of growth. Histologically the tumors could be conveniently classified as oligodendrogliomas and oligodendroblastomas. Certain histogenic variations in general pattern and cellular detail were substantial evidence of a relation to the ependymoma. These tumors did not lend themselves well to grading with respect to degree of malignancy. Perhaps the criteria established for the grading of tumours are not applicable to oligodendrogliomas. It is logical to assume that the factors which influence the rapidity of growth should be reflected in the histologic picture. Possibly future studies will disclose these features, or perhaps a revision of present-day precepts will prove peculiarly applicable to this tumor entity.

(Authors' abstr.)

VOL. LXIV.

JULY.

*Chronic Barbiturate Intoxication. <i>Isbell, H., et al.</i>	I
*Adaptive Behaviour in Long-Surviving Dogs without Neocortex. <i>Wikler, A.</i>	29
Role of Somesthetic Stimuli in the Development of Sexual Excitation in Man. <i>Herman, M.</i>	42
Section of U Fibers of Motor Cortex in Cases of Paralysis Agitans. <i>Cobb, S., et al.</i>	57
*Cephalin-Cholesterol Flocculation and Thymol Turbidity Tests in Schizophrenia. <i>Oltman, J. E., and Friedman, S.</i>	60
Transsynaptic Degeneration in the Visual System. <i>Haddock, J. N., and Berlin, L.</i>	66
Astrocytoma of the Cerebellum. <i>Mabon, R. F., et al.</i>	74
Isolated Neuritis of a Sensory Filament of a Peripheral Nerve Trunk. <i>Gordon, A.</i>	89
Electromyography in Diagnosis of Nerve Root Compression Syndrome. <i>Shea, P. A., et al.</i>	93

PHILADELPHIA NEUROLOGICAL SOCIETY.

Virulent Virus Infection of the C.N.S., etc. <i>Zeritsky, S. A.</i>	136
A New Instrument for Performing Transorbital Leukotomy. <i>Moore, M. T.</i>	137
Wave and Spike Discharges in the E.E.G. <i>Forster, F. M., and Allen, A.</i>	140
Effect of Poliomyelitis on the Function of the Motor Neuron. <i>Denmy-Brown, D.</i>	141
Neurosurgical Procedures for Preservation of Vision in an Adult with Acrocephaly. <i>Leopold, L., et al.</i>	146
Presumptive Diagnosis of Brain Tumor by the Rapid Smear Technic. <i>Liu, C. T., and Adamkiewicz, L. L.</i>	149
Clinicopathologic Study of Intracranial Ependymomas. <i>Scheuerman, W., et al.</i>	150

CHICAGO NEUROLOGICAL SOCIETY.

Intradural Spinal Granulomas. <i>Bucy, P. C., and Oberhill, H. R.</i>	152
Further Experiences with "Phenurone" in Treatment of Epilepsy. <i>Gibbs, F. A., and Garvin, J. S.</i>	152
Familial Occurrence of Multiple Sclerosis and its Implications. <i>Mackay, R. P.</i>	155

Chronic Barbiturate Intoxication: An Experimental Study.

Five men formerly addicted to morphine, who volunteered for the experiment, received doses of secobarbital (seconal(R)), pentobarbital or amobarbital (amytal(R)) sufficiently large to induce continuous mild to severe intoxication for periods varying from 92 to 144 days.

Symptoms of chronic barbiturate intoxication included impairment of mental ability, confusion, regression, increased emotional instability, nystagmus, dysarthria, ataxia in gait and station and depression of the superficial abdominal reflexes. The clinical manifestations of chronic barbiturism were similar to those of chronic alcoholism.

The effects of the same dose of barbiturates varied greatly in the same person from day to day. This variation was partially correlated with changes in food intake. Pronounced differences in the effects of the same dose of barbiturates on different subjects were also observed.

Although the variation in the effects of the drugs made it difficult to determine whether tolerance developed, 4 of the 5 patients, when abruptly returned to the same dose of barbiturates they were receiving at the end of the experiment, became much more intoxicated than they were at any time after attaining the maximum dosage level gradually. Some tolerance, therefore, developed during chronic intoxication.

After abrupt withdrawal of barbiturates a definite abstinence syndrome developed. The barbiturate withdrawal syndrome was characterized by disappearance of the signs of intoxication, weakness, tremor, great anxiety, anorexia, nausea and vomiting, rapid loss of weight, increase in pulse and respiration rates, fever, increase in blood pressure, difficulty in making cardiovascular adjustments in standing, convulsions of *grand mal* type and the development of a psychosis. The barbiturate withdrawal psychosis resembled alcoholic delirium tremens, and was

characterized by anxiety, agitation, insomnia, confusion, disorientation chiefly in time and place, but not in person, delusions and auditory and visual hallucinations.

No changes were observed in the total, true or pseudo-cholinesterase contents of serum during chronic intoxication with barbiturates or after withdrawal.

Recovery from chronic barbiturate intoxication and from the barbiturate withdrawal syndrome appeared to be complete. No clinical evidence of permanent damage was detected sixty days or more after withdrawal began.

During chronic barbiturate intoxication the amplitude of all electroencephalographic waves was increased, and the percentage of waves of frequencies of 15 to 30 cycles per second was greater. After withdrawal of barbiturates, paroxysmal bursts of high amplitude waves of frequencies of 4 to 6 cycles per second appeared in the first 12 to 48 hours. Records obtained during and after a convulsion were similar to records of *grand mal* seizures due to idiopathic epilepsy. Within 30 days after the barbiturates were discontinued the electroencephalographic pattern returned to that seen prior to chronic intoxication.

Barbiturates are addiction-forming drugs, and in some respects addiction to barbiturates is more dangerous and undesirable than is addiction to morphine.

(Authors' abstr.)

Adaptive Behaviour in Long-Surviving Dogs without Neocortex.

The post-operative life-histories of two decorticated dogs, one surviving nineteen and the other twelve months, are presented. Anatomic studies of the brains in these animals revealed no traces of remaining neocortex.

The dogs showed spontaneous changes in the direction of better adaptation with increasing post-operative age in connection with swallowing food, avoiding the walls of their circular pens, extricating themselves from corners, escaping from the grasp of the attendant and attempting to escape from the pen. On the other hand, the preparations showed no recognition of food, food receptacles, the attendant who always fed them or the needle prick which always preceded clyses with saline solution and which regularly evoked rage.

Formal attempts to produce conditioned motor responses to visual and auditory stimuli, either by the classic pavlovian method or by avoidance technics, were not successful. Discrete conditioned motor responses to tactile stimuli were established after prolonged efforts. During attempts to produce conditioned salivation associated with injections of morphine, salivation was observed only as part of a generalized rage response before injection of the drug. Attempts to produce time conditioning of increased motor activity were not successful.

An unconditioned tactile salivatory response was observed, which was intensified by hunger and diminished by feeding. After complete decortication, one of the dogs (an adult male) reverted to the female posture during urination. Decortication did not alter the pattern of the reaction of the dogs to electrical stimulation of the pulp nerves of teeth; the threshold of such reactions appeared to become elevated slightly after the operation.

These observations are discussed with reference to the problem of adaptation and conditioning.

(Author's abstr.)

Cephalin-Cholesterol Flocculation and Thymol Turbidity Tests in Schizophrenia.

The incidences of positive results in cephalin-cholesterol flocculation tests were almost identical among newly hospitalized catatonic patients, patients with non-catatonic schizophrenia and other psychiatric patients. Results for a chronically ill group with long term hospitalization were somewhat equivocal. The results of thymol turbidity tests for chronically ill patients were essentially negative. This study does not lend confirmation to a previously expressed theory that hepatic damage is an etiologic factor in the production of catatonia or other schizophrenic symptoms.

(Authors' abstr.)

AUGUST.

Direct Reorientation of Behavior Patterns in Deep Narcosis. *Brickner, R. M., et al.*

*Recent Contributions to the Anatomy and Physiology of the Cerebellum. 165

Snider, R. S.

196

*Focal E.E.G. Changes in Unilateral E.C.T. *Blaurock, M. F., et al.*

220

Treatment of Tumors of the Pineal Body. <i>Horrax, G.</i>	227
Nature of the Schizophrenic Process. <i>Jenkins, R. L.</i>	243
Deaths Associated with E.C.T. <i>Eyman, E. V., and Morris, H. H., jun.</i>	263

PHILADELPHIA NEUROLOGICAL SOCIETY.

Hemibalism and its Control by Ablation of the Motor Cortex. <i>Alpers, B. J., and Jaeger, R.</i>	285
Use of Benadryl in Treatment of Paralysis Agitans. <i>Moore, M. T.</i>	287
Effects of Bilateral Stellectomy on the Cerebral Circulation of Man. <i>Shenkin, H. A., et al.</i>	289
Clinical Experience with Myanesin in Treatment of Hyperkinetic Disorders. <i>Jeub, R. P.</i>	291
Thymectomy in Treatment of Myasthenia Gravis. <i>Yaskin, J. C., et al.</i>	292
A Study of Meningiomas Occurring in a General Hospital. <i>Bartle, H. M., jun.</i>	294
Pallidothalamotomy in Chorea. <i>Spiegel, E. A., and Wycis, H. T.</i>	295

PHILADELPHIA PSYCHIATRIC SOCIETY.

The Schizophrenic Reactions in Women Following Pregnancy and in Nulliparous Women. <i>Terzian, A. S.</i>	296
Psychotherapy in Neurodermatitis. <i>Silberstein, R. M.</i>	297

Recent Contributions to the Anatomy and Physiology of the Cerebellum.

1. Tactile, auditory and visual areas are known to exist within the cerebellum.
 2. Motor, tactile, auditory and visual areas in the cerebrum project to these same cerebellar areas, which, in turn, project back on the cerebral areas.
 3. It has been established that almost every structure which projects to the cerebellum also receives a projection from it (seldom direct).
 4. Certain areas of the cerebellum when properly stimulated produce localized movements and suppression or facilitation of cortically or reflexly induced movements.
 5. Cerebellar stimulation can modify cerebral activity.
 6. There are single neurologic units within the cerebellar cortex which are spontaneously active. It is believed that these units are Purkinjé cells and/or the granule-basket cell complexes.
 7. It is necessary to abandon the old concepts of a cerebellum which functions as a whole and functions entirely in a proprioceptive sphere.
 8. A new concept of function is developed which includes cerebellar action in dampening and in potentiating associated sensory and motor centers alike. The cerebellum thus becomes the "great modulator of neurologic function."
- (Author's abstr.)

Focal Electroencephalographic Changes in Unilateral Electric Convulsion Therapy.

A group of 14 psychotic patients were subjected to electric convulsion therapy in which a new technic of unilateral electrode placement was employed. Detailed clinical and electroencephalographic observations were made throughout the course of sixteen treatments, with follow-up examinations.

Focal electroencephalographic changes were produced by unilateral placement of stimulating electrodes in electric convulsion therapy.

Vulnerability of the right frontal area for slow wave activity regardless of electrode placement was demonstrated.

The occipital area showed the least vulnerability for focal activity.

Recovery from effects of electric convulsion therapy as recorded by electroencephalogram was faster with unilateral stimulation than with the standard bilateral method of stimulation.

No characteristic convulsive reaction was obtained by unilateral stimulation, but a tendency toward flexion on the left side and extension on the right side was noted when right-sided stimulation was employed. The opposite reaction was less characteristic of left-sided stimulation.

No untoward or complicating clinical, neurologic or electroencephalographic effect was observed with the unilateral method of electric convulsion therapy that was not also seen with the standard bitemporal method. (Authors' abstr.)

SEPTEMBER.

Role of Sympathetic and Parasympathetic Systems in Reflex Dilatation of the Pupil. <i>Lowenstein, O.</i>	313
Mutual Role of Sympathetic and Parasympathetic in Shaping of the Pupillary Reflex to Light. <i>Lowenstein, O., and I. E.</i>	341
*Some Data Concerning the Growth and Development of the Cerebral Cortex in Man: II. <i>Turner, O. A.</i>	378
*Psychic Function and the E.E.G. <i>Ostow, M.</i>	385
Myelomalacia Secondary to Dissecting Aneurysm of the Aorta. <i>Schwarz, G. A., et al.</i>	401
Manic Psychosis in a Case of Parasagittal Meningioma. <i>Oppler, W.</i>	417
Pleocytosis and Meningeal Signs of Uremia. <i>Madonick, M. J., et al.</i>	431
The Psychiatrist in the General Hospital. <i>Alexander, E. J.</i>	437
E.E.G. Studies of the Encephalopathies: I. <i>Roseman, E.</i>	448

NEW YORK ACADEMY OF MEDICINE, SECTION OF NEUROLOGY, ETC.

Principles Underlying the Projective Technics of Personality Measurement. <i>Piotrowski, Z. A.</i>	478
Drawings as Objective Criteria for Neurotic Conflict and their Change During Psychoanalysis. <i>Boernstein, W. S.</i>	479

Some Data Concerning the Growth and Development of the Cerebral Cortex in Man. II. Post-natal Growth Changes in the Cortical Surface Area.

It appears that the general growth of the cerebral hemisphere in post-natal life occurs between birth and the sixth year. The only exception is the frontal lobe, where the growth continues as late as the tenth post-natal year. Except in the occipital lobe two phases of rapid growth can be identified, the first extending from birth to the second year, and the second, somewhat less rapid and less marked, extending from the second to the sixth year. In the occipital lobe rapid growth occurs up to the sixth year, but the two phases are not clearly separated.

In terms of absolute increase, the parietal lobe appears to undergo a greater expansion than does any other lobe of the brain. There was no evidence that growth occurred earlier in any one lobe of the brain than in the others, although there was some indication that in the frontal and in the parietal lobe the process of expansion occurred at a greater rate than it did in either the temporal or the occipital lobe.

There was no evidence confirming Woollard's conclusions that the visual area developed first. There was definite indication that the frontal lobe continued to develop beyond the sixth year period of growth seen in the other lobes of the brain and in the cerebrum in general.

(Author's abstr.)

Psychic Function and the Electroencephalogram.

It is fairly clear that there is no departure from the range of normal frequencies as a result of any variation within the normal range of psychic function as long as the subject remains awake. The prevalence of alpha activity is increased by readiness for constructive cerebration, and is dissipated by constructive cerebration itself. Affective states *per se* are without influence on the electroencephalogram, but whatever alterations in the state of intellectual function are evoked by the affective states are reflected in changes in the prevalence of alpha rhythm. Similarly, variations from subject to subject in the electroencephalographic pattern reflect a personality difference only to the extent that habits of constructive, intellectual function vary.

(Author's abstr.)

ARQ. NEURO-PSIQUIAT.

VOL. VIII.

JUNE, 1950.

Schizophrenics Influenced and Not Influenced by Treatment. <i>Pires, N., et al.</i>	115
The Psychoanalysis of Psychoses. <i>Uchoa, D. M.</i>	131
Pharmaco-dynamic Investigation of the Subconscious. <i>Teixeira, N.</i>	145
Normal Psychology. <i>Doyle, F.</i>	155
The Concept of Discontent in Psychiatry. <i>Levy, M., jun.</i>	171

BR. J. DELINQ.

VOL. I.

JULY, 1950.

- A Note on Capital Executions in the United States. *Sellin, T.* . . . 6
 A Comparative Survey of the Wakefield Prison Population in 1948 (Part I).
Roper, W. F. . . . 15
 Dorothy: The Psychoanalysis of a Case of Stealing. *Schwarz, H.* . . . 29
 The Criminological Institute of the University of Stockholm. *Kinberg, O.* . . . 45
 The Prevention of Delinquency. *Meng, H., and Reiwald, P.* . . . 48
 Public Opinion and Juvenile Delinquency. *Scott, P. D.* . . . 56
 The Dutch Prison System. *Baan, P. A. H.* . . . 60

BR. J. MED. PSYCHOL.

VOL. XXIII.

1950.

- In Search of our Proper Ethic. *Dicks, H. V.* . . . I
 The Psychology of Insulin Coma Treatment. *Scott, R. D.* . . . 15
 The Experimental Validation of the Rorschach Test. *Benton, A. L.* . . . 45
 A Psycho-analytic Approach to Group Treatment. *Ezriel, H.* . . . 59
 Analysis in Later Life. *Cutner, M.* . . . 75
 "Non-speaking" Children. *Jackson, L.* . . . 87
 The Therapeutic Group in Hospital. *Klein, H. S.* . . . 101
 The Psycho-therapist and Extra-sensory Perception. *Rudolf, G. de M.* . . . 105
 In-patient Treatment of Psychotic Adolescents. A Symposium . . . 107

BR. J. PSYCHOL.

VOL. XL.

JUNE, 1950.

- Psychopathology and Social Psychology: II. *MacCurdy, J. T.* . . . 175
 Contrast in Eye and Brain. *Asher, H.* . . . 187
 Two Experiments on Fatigue as Affecting Skilled Performance in Civilian Air
 Crew. *Welford, A. T., et al.* . . . 195
 Speed as a Function of Distance. *Ward, N.* . . . 212
 Variations in the Performance of Some Aestheto-kinetic Tests. *Manning,*
J. R. . . . 217

BULL. LOS ANGELES NEUR. SOC.

VOL. XV.

JUNE, 1950.

- Treatment of Neuronitis with BAL. *Nielsen, J. M.* . . . 61
 The Mechanism of Coup-Contrecoup Injuries of the Brain. *Courville, C. B.* . . . 72
 Paget's Disease and Intracranial Tumor. *Estridge, M. N.* . . . 87
 Traumatic Pneumocephalus. *Yuhl, E. T., and Estridge, M. N.* . . . 93

CANAD. J. PSYCHOL.

VOL. III.

1949.

- New Psychologies of Yesterday and To-day. *MacLeod, R. B.* . . . 199
 The Social, as Distinguished from the Behavioural, Field. *Wright, H. W.* . . . 213
 Meaning, Motives and Social Organization. *Ketchum, J. D.* . . . 218
 Use of the Rorschach Test in the Anthropological Study of a Peasant Society.
Mathieu-Fortin, C. . . . 226

CERVELLO.

VOL. XXVI.

JULY, 1950.

- Malignant Tumours of the Adrenal Cortex with Cushing's Syndrome. *Fattovich, G., and Corvera, M.* . . . 201
 The Nervous System and Immunity. *Vilardi, G.* . . . 230
 The Distinction and Nature of Yellow Pigment in the Anterior Hypothalamic
 Nucleus. *Aragona, F.* . . . 234
 The Association of Vaccine Pyretotherapy and Electroshock. *Sagripanti, P.* . . . 244

SEPTEMBER.

- Histopathological Aspects of the Senile Brain. *Fattovich, G.* . . . 265
 Tuberculosis and Mental Illness. *Cacciapuoti, G. B.* . . . 278
 Solitary Neurinoma of the Facial Nerve. *Cammiti, E.* . . . 291
 Experimental Study of the Pathogenesis of Pulmonary Gangrene in E.C.T.
Viviano, M., and Crosa, G. . . . 324

CONF. NEUROL.

VOL. IX.

1949.

- Thought Disturbance with Reference to Figure-background Impairment in Brain-injured Children. *Werner, H.* 255

DIS. NERV. SYST.]

VOL. XI.

AUGUST, 1950.

- Psychiatric Treatment of Institutionalized Delinquent Adolescent Girls. *Patterson, R. M.* 227
 Evaluation of Modern Psychiatric Therapeutic Measures. *Sands, I. J.* 233
 L.S.D. 25 as an Aid in Psychotherapy. *Busch, A. K., and Johnson, W. C.* 241
 Social Factors in Health. *Moore, H. E.* 244

EDUC. PSYCHOL. MEASMT.

VOL. X.

1950.

- The Theory and Classification of Criterion Bias. *Brogden, H. E., and Taylor, E. K.* 159
 An Investigation of Two Hypotheses Regarding the Nature of the Spatial Relations and Visualization Factors. *Michael, W. B., et al.* 187
 On the Use of Interaction as "Error Terms" in the Analysis of Variance. *Edwards, A. L.* 214
 The Objective Measurement of Dynamic Traits. *Cattell, R. B., et al.* 224
 The Construction and Validation of a Work-Type Auditory Comprehension Reading Test. *Spache, G.* 249
 Validation and Standardization of the A.G.O. General Mechanical Aptitudes Test for the Selection of Civilian Employees, etc. *Poruben, A., jun.* 254
 Three Aids in the Evaluation of the Significance of the Difference Between Percentages. *Lawshe, C. H., and Baker, P. C.* 263
 A Study of Faking on the Kuder Preference Board. *Cross, O. H.* 271
 Psychological Testing for Immigrants in a Vocational Counselling Agency. *Balinsky, B.* 278
 An Investigation of the Personality Traits of Art Students. *Spiaggia, M.* 285
 The Full-Range Picture Vocabulary Test: II. *Ammons, R. B., and Rachele, L. D.* 307
 Does Face Validity Exist? *Adams, S.* 320
 Administration of the Purdue Pegboard Test to Blind Individuals. *Curtis, J. W.* 329
 Evaluating Psychometric Efficiency. *Dumas, F. M.* 332
 Interest and Personality Measures of Veteran and Non-Veteran University Freshmen. *Fassett, K. K.* 338
 Quick Estimation of Multiple R. *Jenkins, W. L.* 346

ENCEPH.

VOL. XXXIX.

1950.

- Hallervorden-Spatz Disease. *Urechia, C. I., et al.* 197
 Aphasia in Heller's Infantile Dementia. *Jakab, I.* 220
 Transference in Collective Psychotherapy. *Dialkine, R., et al.* 248
 A "Bio-electric" Constitution of Hyper-emotivity. *Faure, I.* 286
 Studies on Great French Psychiatrists 297-411

ENFANCE.

VOL. I.

1948.

- Developmental Disorders of the Child and Genetic Problems. *Turpin, R.* 189
 Comparative Study of the Perception and Estimation of Duration in Children and Adults. *Fraisse, P.* 199
 The "Test-Puzzle." *Sommer, A.* 212
 The Children's Home. *Cortez, F.* 232
 An Attempt to Organize an Improvement School. *Ballot, M.* 240
 The Carrard Method and the Vocational Training of Adolescents. *Roche, M.* 245
 Comparison of Normal Pupils with Defective Adults of the Same Mental Age. *Zazzo, R., and Boivin, P.* 248

Baby Tests. <i>Brunet, O.</i>	250
A Sketch of the Motor Development of the Child in the Course of the First Ten Months. <i>Bergeron, M.</i>	256

EVOL. PSYCHIAT.

VOL. XXII.	1950.
Tributes to Pierre Janet	341-497

FIZIOL. ZH. S.S.S.R.

VOL. XXX.	1947.
Concerning the Localization of Changes in the Electrical Processes of the Cerebral Cortex of the Rabbit, etc. <i>Livanov, M. N., and Riabinovskaia, A. M.</i>	523
On the Activity of the Proprioceptors of Different Muscular Groups in the Frog. <i>Maruseva, A. M.</i>	535
The Reaction of Isolated Striped Muscles of a Frog to Audible Sounds. <i>Nasonov, D. N., and Ravdonik, K. S.</i>	568
Intense and Very Intense Representatives of Sanguine Temperament Under Different Conditions of Experiment. <i>Petrova, M. K.</i>	581
An Attempt at a Classification of Imitative Phenomena on the Basis of Experimental Study of Behavior in Birds. <i>Promptov, A. H.</i>	595

FOL. PSYCHIAT. NEURO. NEUROCHIR., NEERLAND

VOL. LIII.	AUGUST, 1950.
On Cerebro-cerebellar Atrophy. <i>Verhaart, W. J. C., and van Wieringen-Rauws, G. A.</i>	481
Electrophoresis in C.S.F. Proteins. <i>Booy, J.</i>	502
The Psychoanalytical and the Psychosophical Interpretation of Fairy-tales. <i>Schuurman, C. J.</i>	509
The Meili-Test as an Indicator of Character. <i>van Krevelen, D. A.</i>	519
On Some Changes of Autonomic Function after Prefrontal Lobotomy. <i>Eringa, P. S.</i>	525
Some Observations on a Case of Dementia Consecutive upon Strangulation. <i>Kraft, T. B.</i>	535

GENET. PSYCHOL. MONOGR.

VOL. XLI.	MAY, 1950.
Awareness of Racial Differences by Pre-school Children in Hawaii. <i>Springer, D. V.</i>	215
Age Trends in Children's Evaluation of Teacher-approved v. Teacher Disapproved Behavior. <i>Witryol, S. L.</i>	271
The Relationship Between Level of Vocational Aspiration and Certain Personal Data. <i>Stubbins, J.</i>	327

IND. J. NEUR. PSYCHIAT.

VOL. II.	1950.
New Drugs and the Nervous System	1
Psyche of the Tuberculosis. <i>Bhattacharjya, B.</i>	4
Indian Norm for Rorschach Responses. <i>Asthana, H. S.</i>	10

INDIV. PSYCHOL. BULL.

VOL. VIII.	1950.
Symposium on Guilt Feelings	4
The Basic Needs of Children	49

INTERNAT. J. PSYCHOANAL.

VOL. XXX.	1949.
Psychoanalysis and Education. <i>Ferenczi, S.</i>	220
Confusion of Tongues Between the Adult and the Child. <i>Ferenczi, S.</i>	225

Notes and Fragments. <i>Ferenczi, S.</i>	231
Ten Letters to Freud. <i>Ferenczi, S.</i>	243
Love for the Mother and Mother-love. <i>Balint, A.</i>	251
Infant and Mother. <i>Pető, E.</i>	260
Early Developmental States of the Ego. <i>Balint, A.</i>	265

VOL. XXXI.

1950.

The Role of Anxiety in Depersonalization. <i>Oberndorf, C. P.</i>	1
"Women who Fall." <i>Leuba, J.</i>	6
Illness Following Dreams. <i>Bartemeier, L. H.</i>	8
Emergence of Hidden Ego Tendencies during Dream Analysis. <i>Blitzston, N. L., et al.</i>	12
The Mother Tongue and the Mother. <i>Greenson, R. R.</i>	18
Homosexuality and Jealousy. <i>Lagache, D.</i>	24
Schreber's Hallucinations about the "Little Men." <i>Kalan, M.</i>	32
Children's Interpretation and Reaction to the Unconscious of their Mothers. <i>Sperling, M.</i>	36
On Consummated Incest. <i>de Rascovsky, M. W. and A.</i>	42
Psyche in Nature or the Limits of Psychogenesis. <i>Bonaparte, M.</i>	48
On the Pathogenesis of Peptic Ulcer. <i>Garma, A.</i>	53
Chronic, Exudative, Discoid and Lichenoid Dermatitis. <i>Schur, M.</i>	73
On the Criteria for the Termination of a Psychoanalysis. <i>Klein, M.</i>	78
On Counter-transference. <i>Heimann, P.</i>	81
Psychodynamics of the "Intellectual." <i>Kupper, H. J.</i>	85
Masochism as a Pathological and as a Normal Phenomenon in the Human Mind. <i>de Monchy, R.</i>	95
The Mechanisms of Regression in the Poetry of Baudelaire and his Followers. <i>Kucera, O.</i>	98
Poetry and the Memories of Childhood. <i>Flournoy, H.</i>	103
The Significance of Freud's Earliest Discoveries. <i>Kris, E.</i>	108

INT. Z. INDIV.-PSYCHOL.

VOL. XVII.

1948.

Society as Idea and Reality. <i>Spiel, O.</i>	145
Is there a Convergence of the Teachings of the Depth Psychologies? <i>Birnbaum, F.</i>	156
Progress or Retrogression. <i>Fischl, P.</i>	172
On Left-handedness. <i>Plotke, P.</i>	177
From the Life of a Displaced Person. <i>Sorge-Boehmke, E.</i>	179
Aha-experience and Therapy. <i>Spiel, L.</i>	184

J. AB. SOC. PSYCHOL.

VOL. XLV.

JULY, 1950.

Some Personality and Social Factors Related to Changes in Children's Attitude Toward Negroes. <i>Mussen, P. H.</i>	423
Attitude and Structure as Factors in the Distortion of Reasoning. <i>Thistlethwaite, D.</i>	442
Perceptual Selectivity in Rorschach Determinants as a Function of Depressive Tendencies. <i>Blake, R. B., and Wilson, G. P., jun.</i>	459
Changes in Performance in Relation to Influences upon Self-conceptualization. <i>Benjannis, J.</i>	473
Some Data Bearing on the Oedipus Hypothesis. <i>Winch, R. F.</i>	481
An Inquiry Concerning the Characteristics of Man. <i>Cantril, H.</i>	491

J. CLIN. PSYCHOL.

VOL. VI.

JULY, 1950.

The Most Unpleasant Concept Test. <i>Harrower, M. R.</i>	213
Research in Clinical Psychology, 1949. <i>Schofield, W.</i>	234
Psychiatric Opinions on Personality Factors in Psychotherapy. <i>Mensh, I. N., and Watson, R. I.</i>	237
T.A.T. of Crippled Children. <i>Broida, C., et al.</i>	243

Rorschach Signs of Homosexuality in Male College Students. <i>Fein, L. G.</i>	248
The Prediction of Academic Success by Means of "Weighted" Harrower-Rorschach Responses. <i>Osborne, R. T., et al.</i>	253
Rorschach Characteristics of Duodenal Ulcer Patients. <i>Osborne, R. T., and Sanders, W. B.</i>	258
A Consideration of Factor Loadings on the Szondi Test. <i>Guertin, W. H.</i>	262
Alcoholic Profiles on the M.M.P.I. <i>Brown, M. A.</i>	266
Wechsler-Bellevue Changes Following Prefrontal Lobotomy. <i>McCullough, M. W.</i>	270
The Prediction of Teacher-Pupil Interaction with a Projective Test. <i>Alexander, T., jun.</i>	273
The Relative Difficulty of Various Tests for Sixty Feeble-minded Individuals. <i>Arthur, G.</i>	276
Schizophrenia and the M.M.P.I. <i>Wanck, Le R. A.</i>	279
Changes in Goodenough Drawings Associated with Changes in Social Adjustment. <i>Ochs, E.</i>	282
Prediction of the Response of Schizophrenic Patients to E.C.T. <i>Pearson, J. S.</i>	285
Intellectual Disparities in a Normal Group and their Relationship to Emotional Disturbance. <i>Fisher, S., and Sunukjian, H.</i>	288
Animal Pictures for Obtaining Children's Projections. <i>Bills, R. E.</i>	291
A Study of the Validity of the T.A.T. and a Set of Animal Pictures. <i>Bills, R. E., et al.</i>	293
An Adolescent Problem Reflected in the T.A.T. <i>Bellak, L., et al.</i>	295
The Nature of Rorschach Responses from Pulmonary Tuberculosis Patients. <i>Ellis, R. W., and Brown, G. G.</i>	298

J. COMP. NEUR.

VOL. XCII.	JUNE, 1950.
Motor Mechanisms of the Anuran Brain. <i>Abbie, A. A., and Adey, W. R.</i>	241
Analysis of Choreoid Hyperkinesis in the Rhesus Monkey. <i>Carpenter, M. B., et al.</i>	293
Intramedullary Sensory Ganglion Cells in the Roof Plate Area of the Embryonic Human Spinal Cord. <i>Humphrey, T.</i>	333
On the Anatomical and Functional Organization of the Spinal Trigeminal Nucleus. <i>Olszewski, J.</i>	401

J. COMP. PHYSIOL. PSYCHOL.

VOL. XLIII.	JUNE, 1950.
A Methodological Study of Extinction Following Aperiodic and Continuous Reinforcement. <i>Jenkins, W. O., et al.</i>	155
Evidence for Continuity in the Discrimination of Vertical and Horizontal Patterns. <i>Richie, B. F., et al.</i>	168
Hormonal Modification of Social Behavior: IV. <i>Birch, H. G., and Clark, G.</i>	181
Latent Learning under Conditions of High Motivation. <i>Strange, J. R.</i>	194
Some New Experiments of the Nature of Discrimination Learning in the Rat. <i>Bitterman, M. E., and Coate, W. B.</i>	198
Observations on Strictly Simultaneous Conditioned Reflexes. <i>Cohen, J.</i>	211
The Hoarding of Non-relevant Material by the White Rat. <i>Ross, S., et al.</i>	217
Visual Perception and Insight in Rats. <i>Brown, W. L., and Gentry, G. V.</i>	226

AUGUST.

Performance of Catarrhine Monkeys on a Series of Discrimination Reversal Problems. <i>Harlow, H. F.</i>	231
Incidental Learning in the Rat. <i>Seward, J. P., et al.</i>	240
Habit Reversal after Electroshock Convulsions as a Function of the Difficulty of the Tasks. <i>Braun, H. W., and Patton, R. A.</i>	252
Influence on Handedness of Acetylcholine Locally Applied with other Chemicals to the Cerebral Cortex of the Rat. <i>Peterson, G. M., and Rigney, J. W.</i>	264
The Effects of Intra-maze Delay. <i>Brown, W. L., and Sjöberg, W. E., jun.</i>	272
A Note on the Genetic Basis of Spontaneous Activity in the Albino Rat. <i>Brody, E. G.</i>	281

Learning and Satiation of Response in Intrinsically Motivated Complex Puzzle Performance by Monkeys. <i>Harlow, H. F.</i>	289
Experimental Analysis of the Hoarding Habit in the Rat: I. <i>Marx, M. H.</i>	295
The Dynamic Characteristics of the Semicircular Canals. <i>Mayne, R.</i>	309
Gustatory Nerve Discharges in Normal and Adrenalectomized Rats. <i>Pfaffmann, C., and Bare, J. K.</i>	320
The Nature of the Memory Decrement Following Electroconvulsive Shock. <i>Worchel, P., and Narciso, J. C.</i>	325

J. CONS. PSYCHOL.

VOL. XIII.	1949.
Mental Deficiency—Symptom or Disease. <i>Axline, V. M.</i>	313
Psychological Tests in Clinical Research. <i>Shafer, R.</i>	328
A Factor Analysis of Discrete Responses to the Rorschach Ink Blots. <i>Wittenborn, J. R.</i>	335
The Rorschach as a Measure of Intelligence. <i>Altus, W. D., and Thompson, G. M.</i>	341
Validation of the Rotter Incomplete Sentences Blank for College Screening. <i>Rotter, J. R., et al.</i>	348
Validity of Short Forms of the Wechsler-Bellevue Scale for Mental Defectives. <i>Cotzin, M., and Gallagher, J. J.</i>	357
A Suggested Method for Analyzing and Extending the Use of Bellevue-Wechsler Vocabulary Responses. <i>Gerstein, R. A.</i>	366
Group Psychiatric Screening of Military Recruits. <i>Hanawalt, N. G.</i>	371
The Relationship of Intelligence and Years of Schooling when Literacy is Held Constant. <i>Altus, W. D.</i>	375
Lifetime Worry Patterns of American Psychologists. <i>Kerr, W. A., et al.</i>	377
New Directions for Projective Techniques. <i>Symonds, P. M.</i>	387
Diagnosis of Learning Disabilities Through a Projective Technique. <i>Monroe, R. L.</i>	390
Racial Attitudes Revealed by a Projective Technique. <i>Reynolds, R. T.</i>	396
The Use of the Sentence Completion Test in Differentiating Between Well-adjusted and Maladjusted Secondary School Pupils. <i>Wilson, I.</i>	400
A Marriage Problem Story Completion Test. <i>Komisar, D. D.</i>	403
Projective Movement Sequences. <i>Lundin, W. H.</i>	407
Nonmeaningful Verbal Structures Used as Projective Material. <i>Hutchins, L. C.</i>	412
Dream Interpretation as a Projective Technique. <i>Day, D.</i>	416
Relation of Design Reproduction to the Etiology of Mental Deficiency. <i>Cassel, R. H.</i>	421
Adjustment and Food Aversions Among Army Illiterates. <i>Altus, W. D.</i>	429
An Evaluation of the Use of Bellevue-Wechsler Subtest Scores as an Aid in Psychiatric Diagnosis. <i>Wittenborn, J. R.</i>	433
The Relative Rates of Decline of Wechsler-Bellevue "Hold" and "Don't-Hold" Tests. <i>Hunt, W. L.</i>	440
Subtest Variation on the Wechsler-Bellevue for Two Institutionalized Behavior Problem Groups. <i>Altus, W. D., and Clark, J. H.</i>	444
The Record and a Sentence Completion Test. <i>Stein, M. I.</i>	448

J. EXP. PSYCHOL.

VOL. XL.	AUGUST, 1950.
An Experimental Analogue to Repression: II. <i>Zeller, A. F.</i>	411
The Effect of Different Types of Preliminary Activities on Subsequent Learning of Paired-Associate Material. <i>Thune, L. E.</i>	423
Stimulus Pre-differentiation as a Factor in Transfer of Training. <i>Gagné, R. M., and Baker, K. E.</i>	439
Retention as a Function of Stage of Practice. <i>Greenberg, R., and Underwood, B. J.</i>	452
A Quantitative Comparison of the Discriminative and Reinforcing Functions of a Stimulus. <i>Dinsmoor, J. A.</i>	458
Resistance to Extinction of a Conditioned Operant as Related to Drive Level at Reinforcement. <i>Strassburger, R. C.</i>	473
The Effect of Extinction upon Rate of Reconditioning. <i>Deese, J.</i>	488

- A Study of Concept Formation as a Function of Reinforcement and Stimulus Generalization. *Buss, A. H.* 494
- The Learning and Retention of Concepts: V. *Reed, H. B.* 504
- Sensory Conditioning Measured by the Facilitation of Auditory Acuity. *Brogden, W. J.* 512
- The Relation of Vernier and Depth Discrimination to Width of Test Rod. *Berry, R. N., et al.* 520
- An Experiment on the Expressiveness of Shell and Textile "Montages." *Campbell-Fisher, I. G.* 523
- An Hypothesis Concerning the Generation and Use of Synonyms. *Lepley, W. M.* 527
- The Relationship Between the Tilt of a Visual Field and the Deviation of Body Position from the Vertical in the White Rat. *Reiss, B. F., et al.* 531

J. GEN. PSYCHOL.

VOL. XLII.

APRIL, 1950.

- The Effect of Negative Incentives in Serial Learning: II. *Stone, G. R.* 179
- Some Theoretical Implications of Roger's Non-directive Therapy. *Howie, D.* 225
- An Examination of the System of Professor K. S. Lashley. *Erickson, R. W.* 243
- Learning as Selection. *Klee, J. B.* 261
- New Experimental Attempts at Preventing Mechanization in Problem Solving. *Luchins, A. S., and E. H.* 279
- Constitutional Shyness. *Litwinski, L.* 299
- Psychology as a Genetic Science. *Lichtenstein, P. E.* 313
- Toward a Calculus of Behavior. *Lapom, A.* 333
- Visual Factors in Sighting at Dim Levels of Illumination. *Warden, C. J.* 349

VOL. XLIII.

JULY.

- Visual Factors in Sighting at Dim Levels of Illumination. *Ross, S., and Warden, C. J.* 3
- An Investigation into the Relationship Between Psychometric Patterns and Psychiatric Diagnosis. *Kogan, W. S.* 17
- A Linguistic Law of Constancy. *Baker, S. J.* 47
- Mesmer: An Inquiry into the Antecedents of Hypnotism. *Winters, B.* 63
- Correlates of Scattered Speech in the Responses of Normal Subjects to Incomplete Sentences. *Cameron, N., and Magaret, A.* 77
- A Factor Analyses of Rorschach Diagnostic Signs. *Hughes, R. M.* 85
- A Perceptual-motivational Theory of the Occurrence and Intensity of Emotion. *Meyer, H. D.* 105

J. GENET. PSYCHOL.

VOL. LXXVI.

JUNE, 1950.

- A Report on Psychological Studies of the Chinese Languages in the Past Three Decades. *Ai, J. W.* 207
- The Relationship Between the Audiogenic Seizure and Middle-ear Disease. *Marx, M. H., and Junko, M.* 221
- A Study of Factors Influencing Performance of Dogs on a Delayed Response Test. *Fuller, J. L., and Gillum, E.* 241
- Cognitive Maps and Reinforcement. *Fredericson, E.* 253
- The Meaning of Democracy to Sixth-grade Children. *Zeligs, R.* 263
- The Development of Affectionate Behavior in Infancy. *Banham, K. M.* 283
- Developmental Trends in Reading Behavior. *Ilg, F. L., and Ames, L. B.* 291
- The Effects of Intra-maze Tetanizing Shock upon the Learning and Behavior of the Rat in a Multiple-T Maze. *Brown, W. L.* 313
- Reactions to a Projective Doll-play Interview of White Males Two to Six Years of Age, etc. *Ammons, R. B.* 323

J. NERV. MENT. DIS.

VOL. CXII.

JULY, 1950.

- Disintegration of Motor Function Resulting from Cerebral Lesions. *Denny-Brown, D.* 1
- Psychiatry and Religion. *Galdston, I.* 46

- Effects of Anterior Cerebral Occlusion with Varying Levels of Blood Pressure in the Macaque. *Thompson, R. K., and Rhode, C. M.* 58
- The Major Cause of Warfare—Emotional Incompetency. *Stein, S. I.* 66

AUGUST.

- Cutaneous Thresholds for Pain Before and After Unilateral Prefrontal Lobotomy. *King, H. E., et al.* 93
- Emotions Induced and Studied in Hypnotic Subjects: II. *Bull, N., and Gidro-Frank, L.* 97
- Disturbances in Time Discrimination in Organic Brain Disease. *Coheen, J. J.* 121
- Lower Nephron Nephrosis Following E.C.T. *Goodman, L.* 130
- Psychoneurotic Veterans in Industry. *Kurland, A. A., et al.* 152

SEPTEMBER.

- Studies in Epilepsy. *Barker, W., et al.* 187
- Mild Manic-Depressive Psychosis, Depressive Type. *Campbell, J. D.* 206
- Amnesia for Left Limbs and Loss of Interest and Attention in Left Fields of Vision. *Frantz, K. E.* 240
- Sodium Amytal as a Causative Factor in Some Cases of Prolonged Insulin Coma. *White, R. B., et al.* 245

J. NEUR. NEUROSURG. PSYCHIAT.

- VOL. XIII. AUGUST, 1950.
- Denervation Changes in Mammalian Striated Muscle. *Sunderland, S., and Ray, L. J.* 159
- *The Effects of Lesions in the Cingular Gyrus and Adjacent Areas in Monkeys. *Glees, P., et al.* 178
- Normal Mentality Associated with a Maldeveloped "Rhinencephalon." *Nathan, P. W., and Smith, M. C.* 191
- Thalamic Projection to Frontal Cortex in Man. *McLardy, T.* 198
- *The Penetration of Particulate Matter from the C.S.F. into the Spinal Ganglia, etc. *Brierley, J. B.* 203
- Syphilitic Optic Neuritis. *Graveson, G. S.* 216
- Ocular Palsies with Nasal Sinusitis. *Dimsdale, H., and Phillips, D. G.* 225
- *Neurotic Tendencies in Epilepsy. *Eysenck, M. D.* 237

The Effects of Lesions in the Cingular Gyrus and Adjacent Areas in Monkeys.

Lesions of the anterior cingular gyrus (area 24), with varying involvement of neighbouring areas, but still comprising a limited lesion of the medial frontal surface of the hemisphere, were made in five rhesus and two cebus monkeys; one was unilateral, the remainder bilateral.

The animals were subsequently observed for 2 to 14 weeks. Behaviour changes noted by other workers were confirmed. In all but two, a very old monkey with bilateral lesions and the monkey with a unilateral lesions, there was an increased tameness and reduction of aggressiveness, with apparent loss of the sense of danger. These changes tended to disappear after a few weeks. Continual restless pacing occurred in three animals and also gradually subsided after two weeks.

Fibre connections of the anterior part of area 24 could be demonstrated by the Marchi method into areas 6, 8, 9, 10 and 29, and into the anterior border of area 4. Most of these areas also send fibres back into the cingular cortex. From the posterior part fibres pass into the anterior nucleus of the thalamus.

(Authors' abstr.)

The Penetration of Particulate Matter from the Cerebrospinal Fluid into the Spinal Ganglia, Peripheral Nerves and Perivascular Spaces of the Central Nervous System.

The literature relating to the subarachnoid "cul-de-sac" is reviewed.

A technique for introducing an india ink suspension into the cisterna magna of the rabbit without resultant rise in intracranial pressure is described.

Forty-eight hours after the introduction typical "ink-cuffs" are seen at the proximal poles of the root ganglia.

There is naked-eye evidence of spread of the ink over the surface of the ganglia, particularly in the ganglia of the sciatic nerve.

The distribution of ink over the cerebral hemispheres, brain stem and cerebellum is described.

Histological examination revealed (normal material) that the subarachnoid space terminates near the proximal pole of the root ganglion as a well-defined cul-de-sac.

India ink particles accumulate in the cul-de-sac, whence they pass into the subdural space, into the substance of the ganglion and finally into the mixed spinal nerve.

The perivascular spaces of the central nervous system contain amounts of india ink that vary with the degree of filling of the adjacent subarachnoid space.

The perivascular spaces of the hippocampus, globus pallidus and cerebellum were well filled in all members of the series.

The physiological and pathological significance of these findings is discussed.
(Author's abstr.)

Neurotic Tendencies in Epilepsy.

An experiment was designed to investigate the hypothesis that patients suffering from epileptic seizures tend to be emotionally unstable, immature and neurotic persons.

Three tests known to differentiate neurotic from normal groups were given to 38 epileptic patients, 20 female and 18 male, whose average age was 23 and who were of roughly average intelligence.

When test results were compared with those of normal groups it was found that on all three tests the average score of the epileptic group was roughly one standard deviation below that of the normal groups. This difference was tentatively equated with neuroticism.

It was shown that there was no correlation between length of illness and degree of neuroticism—a result which would seem to negative the theory that neuroticism in the epileptic is merely a reaction to his illness.

It was also shown that the more neurotic subjects tended to have lower abstract intelligence scores, lower vocabulary scores, and lower conceptual quotients on the Shipley-Hartford scale. (The conceptual quotient is often taken to indicate intellectual deterioration.)

The results of the experiment may thus be interpreted as supporting the original hypothesis, and it is concluded that epileptics tend to have a stronger neurotic predisposition than non-epileptics.
(Author's abstr.)

J. NEUROPATH. EX. NEUR.

VOL. IX.

JULY, 1950.

Post-infectious Encephalomyelitis. Van Bogaert, L.	219
*Anatomical Study of Lobotomy. Yakovlev, P., and Sweet, W. H.	250
Xanthoma of the Choroid Plexus in Man. Wolf, A., et al.	286
Neuropathological Findings in Phenylpyruvic Oligophrenia. Alford, E. C., et al.	298
Cerebral Contusion in Accidental Electrocution. Hassin, G. B.	311
Primary Mesenchymal Tumors of the Brain, etc. Troland, C. E., et al.	322
Changes in the Arteriae Nervorum in Peripheral Injuries in Man. Woodhall, B., and Davis, C.	335
Uraemia Encephalitis. Tichy, F. Y.	344
Combined Staining of Iron and Fat in Frozen Sections. Strassmann, G.	347

Anatomical Study of Lobotomy. Survey of Six Specimens from 11 to 235 days Post-operative Survival.

The objectives of this study lie primarily in the anatomical field of inquiry. These objectives were only partially fulfilled because of the relatively short period of post-operative survival, and especially because the preoperative and postoperative pathologic changes, either unrelated to or complicating the surgically inflicted

lesions, made difficult the interpretation of the secondary degenerations of nuclei and fiber tracts in the brain and brain stem.

1. The neuropathological study showed that in three specimens (4, 5 and 6) a more or less severe atrophying cerebral process was present for some time before the operation. In Case 4 the atrophy of the frontal lobes and the hydrocephalus *ex vacuo* were so severe as to cast doubt on the relevance of psychosurgery in this case. This would seem to indicate the need of a radiographic study of the cranial contents prior to lobotomy, especially in patients who have been hospitalized for many years, such as the so-called "deteriorated" schizophrenics.

2. Cerebral lesions directly related to surgery of the brain were of two orders: the mechanical dissolution of the continuity of the cerebral substance by the surgeon's instruments (aspiration needle, blunt leucotome, retractors, etc.,) and the necrosis of the tissues which were not directly damaged but became devitalized as a result of interference with their blood supply.

3. The extent and severity of parasurgical necrosis in the authors' material seemed to be greater when the aspiration needle was used, and comparatively less when the blunt leucotome was used to sever the continuity of the cerebral substance in the frontal lobes.

4. The neuropathologic post-operative and intercurrent complications observed in the authors' material were vascular, local infective by extension from the scalp wound, systemic infective by spread from visceral septic foci, and cerebral metabolic.

5. The topographic study of surgical section showed that as a rule the orbito-mesial quadrants of the frontal lobes were severed, involving the cingulate gyrus, while the dorso-lateral or convexal quadrants were largely spared. The symmetrical and consistently bilateral degeneration of the fibers in the dorso-medial or juxtacaudate part of the anterior limb of the internal capsule, in the subthalamic region, and in the rostro-mesial quadrants of the pons in cases of more than two months' post-operative survival was the most conspicuous anatomical finding. The inference is close at hand that the fronto-pontine tracts were bilaterally and symmetrically degenerated as a result of their surgical section close to the areas of their origin in the frontal lobe—areas 10 (FE), mesial 9 (FD) and 8 (FC).

6. The salient point of this anatomical study of lobotomy is that in all six specimens the cingulate gyrus was involved, and the orbito-mesial ectocortex (isocortex) of areas 10 (FE), mesial 9 (FD) and 8 (FC) was undercut and isolated from the mesocortex (transitional cortex) of the cingulate gyrus (area 24 (LA)), orbital limbus (posterior part of area 11 corresponding to Economo's fields FH, FHI, FFa and island of Reil (areas 13–16 of Brodmann)). These rostral orbito-mesial areas of the frontal lobes remained connected to the more primordial mesocortical parts of the brain only through the matricial synaptic ground-work (neuropil of Herrick-Coghill) of the convexal cortical plate and through its short and long arcuate associate systems. Not only the thalamo-frontal radiations, but the pathway descending from the anterior half of the cerebral hemisphere to the brain stem and spinal cord was deprived of a large and important component of fronto-subthalamic, fronto-pontine, and probably other corticofugal fibers of the frontal lobe.

7. On the basis of the authors' study it seems that the degeneration of the anterior thalamic radiations and nuclei following frontal lobotomy has been stressed at the exclusion of the even more obvious degeneration of the far greater mass of efferent projections which connect the frontal lobes to all the levels of the neuraxis "in series" and "in parallel" (15). These efferent projection systems are equally important, and must be taken into consideration in the construction of a valid conceptual schema of the anatomico-clinical correlation between the frontal lobotomies (and other injuries to the brain) and the reorganization of the overt behavior which follows them.

(Authors' abstr.)

J. NEUROSURG.

VOL. VII.

JULY, 1950.

Neurosurgery is What you Make It. <i>Turnbull, F.</i>	289
Intramedullary Spinothalamic Tractotomy. <i>D'Errico, A.</i>	294
A Study of 182 Patients with Verified Astrocytoma, Astroblastoma and Oligodendroglioma of the Brain. <i>Davis, L., et al.</i>	299
Interhemispherical Subdural Suppuration. <i>List, C. F.</i>	313

- Variations in the Trifurcation of the Semilunar Ganglion and Surgical Implications. *Gass, H., and Van Wagenen, W. P.* 325
- *Unilateral Prefrontal Lobotomy for the Relief of Intractable Pain. *Scarff, J. E.* 330
- The Surgery of Epilepsy. *Meyers, R., et al.* 337
- Intervertebral Foramen Studies: I. *Hadley, L. A.* 347
- Ibid:* II. *Hadley, L. A.* 352
- Gliomas Involving the Splenium of the Corpus Callosum. *Schlesinger, B.* 357
- Gynecomastia in Paraplegic Males. *Cooper, I. S., et al.* 364
- A Contribution to the Physio-pathology of the Choroid Plexus. *Davis, L.* 368

Unilateral Prefrontal Lobotomy for the Relief of Intractable Pain.

Unilateral prefrontal lobotomy performed for the relief of pain in 58 consecutive cases yielded good results in 66 per cent., fair results in 20 per cent., and poor results in 14 per cent. This operation produces a relative rather than an absolute barrier to conscious pain perception. Experience indicates that the effectiveness of unilateral lobotomy is permanent for pain of constant severity. Pain of psychogenic origin has not been relieved by unilateral lobotomy. (Author's abstr.)

J. PARAPSYCHOL.

- VOL. XII. 1948.
- Psychiatry and Parapsychology. *Ehrenwald, J.* 6
- Some Suggested Research Projects in Parapsychology. *Hart, H.* 12
- What Needs to be Done in Parapsychology. *Murphy, G.* 15
- Program for Parapsychology. *Pratt, J. G.* 20
- Future Work in Parapsychology. *Price, H. H.* 25
- Concerning a Program for Parapsychology. *Reeves, M. P.* 31
- The Next Ten Years in England. *Soal, S. G.* 32
- Parapsychology: Position Program, Outlook. *Tyrrell, G. N. M.* 36
- Future Aims in Parapsychology Experiments. *West, D. J.* 42
- Extrasensory Perception of Cards in an Unknown Location. *McMahan, E. A., and Lauer, J.* 47
- Conditions Favoring Success in Psi Tests. *Rhine, J. B.* 58
- Psychoanalysis and Parapsychology. *Eisenbud, J.* 83
- A Suggested Program for Parapsychology. *Gibson, E. P.* 86
- A Ten-year Program for Parapsychology. *Humphrey, B. M.* 96
- Research Aims for the Decade Ahead. *Rhine, J. B.* 101
- Research Projects in Parapsychology. *Schmeidler, G. R.* 107
- A Program for Parapsychology. *Thouless, R. H.* 113
- Some Basic Problems for Parapsychological Research. *Woodruff, J. L.* 123
- Spontaneity as a Factor in E.S.P. *Schener, W. B.* 126

J. PERSONAL.

- VOL. XVIII. JUNE, 1950.
- Interaction Processes and Personal Codification. *Ruesch, J., and Prestwood, A. R.* 391
- The Warm-Cold Variable in First Impressions of Persons. *Kelley, H. H.* 431
- The Relation of Somatotype to Self-Ratings on Sheldon's Temperamental Traits. *Child, I. L.* 440
- The Relation of Somatotype to Reaction Time, Resistance to Pain and Expressive Movement. *Janoff, I. Z., et al.* 454
- A Measure of Personality Integration in Relation to the Concept of Self. *McQuitty, L. L.* 461
- Investigation into the "Self-Concept:" I. The W-A-Y Technique. *Bugental, J. F. T., and Zelin, S. L.* 483

J. PROJ. TECHN.

- VOL. XIV. JUNE, 1950.
- Rorschach "Card-Pull" in a Normal Adolescent Group. *Ranzoni, J., et al.* 107
- History of Form-Level Appraisal in the Rorschach. *Kimball, A. J.* 134

SEPTEMBER.

- Evaluation of Form-level in the Rorschach. *Kimball, A. J.* 219
 Psychological Report on the Cyprus Psychiatric Mission. *Oppenheim, S.,*
and Goldwasser, M. L. 245

J. PSYCHOL.

- VOL. XXX. JULY, 1950.
 Introduction to Some Principles of Applied Cybernetics. *Barrett, E., and*
Post, G. 3
 Cybernetics as Applied to a Study of Normal and Abnormal Adjustment
 Mechanisms. *Barrett, E.* 11
 Relative Roles of the Learning and Motor Factors Involved in the Digit
 Symbol Test. *Burik, T. E.* 33
 Accommodation, Convergence and their Relation to Apparent Distance.
Ittelson, W. H., and Ames, A. 43
 Humm-Wadsworth Temperament Scale Appraisals Compared with Criteria
 of Job Success in the Los Angeles Police Department. *Humm, D. G.,*
and K. A. 63
 The Persistence of Vocational Preference in Successful Individuals. *Somer-*
ville, A. W., and Sumner, F. C. 77
 Learning Performance of Young Rats Subjected to Convulsive and Sub-
 convulsive Electro Shocks. *Braun, H. W., et al.* 81
 The Role of Past Experience in Visual Perception. *Pratt, C. C.* 85
 Conformity vs. Prejudice as Exemplified in White Negro Relations in the South.
Black, P., and Atkins, R. D. 109
 The Function of the Human Frontal Lobe. *Landis, C., et al.* 123
 The Treatment of Humorous Responses in the Rosenzweig Picture-Frustration
 Study. *Rosenzweig, S.* 139
 Implantation of Group Interpersonal Relationships through Psychotherapy.
Stoute, A. 145
 Electroconvulsive Thresholds in Rats as Functions of Various Types of Stimu-
 lating Currents. *Pierce, J. F., et al.* 157
 Aptitudes of College Students Toward Marriage and Related Problems: I.
Vail, J. P., and Standt, V. M. 171
 Emotionally-toned Items in Public Opinion Measurement: I. *Klopfer, F. D.,*
and Darsky, B. J. 191
 Isolation as a Factor in Lowering the Threshold of Visual Perception. *Darage,*
R. H., and Sumner, F. C. 195
 Intra-family Resemblances in Personality Characteristics. *Roff, M.* 199
 A Study of Combat Leadership in the Air Force by Means of a Rating Scale.
Roff, M. 229

J. PSYCHOL. NORM. PATH.

- VOL. XLII. 1949.
 On Representation and Abstraction in Painting. *Degand, L.* 129
 Linguistics and Sign Theory. *Kurylowicz, J.* 170
 Aspects of the Mythology and Symbolism of the Bambara. *de Ganay, S.* 181
 Intelligence and Perception According to the Recent Works of Jean Piaget.
Guillaume, P. 202

J. SOC. PSYCHOL.

- VOL. XXXI. MAY, 1950.
 A Factorial Study of Social Attitudes. *Sanai, M.* 167
 A Multiple Scale of Attitudes Toward the British. *Hanchett, G.* 183
 The Sex, Love and Marriage Questions of Senior Nursing Students. *Ellis, A.,*
and Fuller, E. W. 209
 A Study of Religious Attitudes. *Telford, C. W.* 217
 Reducing Ethnic Hostility Through Psychotherapy. *Haimowitz, M. L., and*
N. R. 231
 Inter-relation and Matching of Personality Factors from Behaviour Rating,
 etc. *Cattell, R. B., and Saunders, D. R.* 243

Psychology of the Free Competition of Ideas. <i>Kerr, W. A.</i>	261
The Communicative Act. <i>Smith, M.</i>	271
Feminine Fashion as an Aspect of Group Psychology. <i>Cobliner, W. G.</i>	283

NERV. CHILD.

VOL. VIII.	1949.
Short Analytic Therapy. <i>Schmideberg, M.</i>	281
Briefer Psychotherapy in Psychosomatic Disorders of Children and Adolescents. <i>Mittelman, B.</i>	291
Treatment of Character-Conditioned Hostility in Adolescents. <i>Sobel, R.</i>	311
Psychotherapy Through Child Guidance. <i>Dreikurs, R.</i>	311
The Short-Term Children's Adjustment Clinic of Beth David Hospital in New York City. <i>Harms, E.</i>	329
Some Short-term Considerations Regarding Institutional Care of Mentally Sick Children. <i>A. B. C.</i>	344
Brief Psychological Measures. <i>Mensh, I. N.</i>	349

NEUROPSYCHIAT.

VOL. I.	1950.
Degeneration of the Pallidum of Hallervorden-Spatz Type with Gasteromalacia. <i>Moyano, B. A., and Molina, C. A.</i>	97
Optic Atrophy in Neurosyphilis. <i>Ordando, R., and Arndt, M.</i>	110
Epilepsy and the Diencephalon. <i>Ortiz de Zarate, J. C., and Geile, J.</i>	136
Action of Glutamic Acid on the C.N.S. <i>Saur, J. J.</i>	148
Vesical Dystonia and Neuropsychiatric Syndrome. <i>Irazu, J.</i>	159

OCCUP. THER. REHAB.

VOL. XXIX.	JUNE, 1950.
Music as an Adjunct in the Training of Children with Cerebral Palsy. <i>Snow, B. H., and Fields, B.</i>	147

AUGUST.

Neuromuscular Re-education in the Rehabilitation of Cerebral Palsy. <i>Cailliet, R.</i>	205
Selection of Music to Accompany E.C.T. <i>Price, H. G., et al.</i>	220

PROC. ROY. SOC. MED.

VOL. XLIII.	JULY, 1950.
Biochemical Methods in the Treatment of Alcoholism, with Special Reference to Antabuse. <i>Jacobsen, E.</i>	519

AUGUST.

Discussion of Speech Defects in Children	579
Discussion on Some Aspects of Schizophrenia	623

PSYCHIAT.

VOL. XIII.	MAY, 1950
The Place of Action in Personality Change. <i>Wheelis, A.</i>	135
The Psychodynamic Process of Illness and Recovery in a Case of Catatonic Schizophrenia. <i>Angyal, A.</i>	149
Authority and Liberty in the Structure of Freud's Thought. <i>Riesman, D.</i>	167
A Psychotic Personality in the South Seas. <i>Spiro, M. E.</i>	189
Frustration Tolerance, Frustration Susceptibility and Overt Disturbance. <i>Lindzey, G.</i>	205
Group Reading in Mental Hospitals. <i>Powell, J. W.</i>	213
A Pilot Study of Psychoanalytic Practice in the United States. <i>Kubie, L. S.</i>	227
Patterns of Parent-child Relationships in Schizophrenia. <i>Reichard, S., and Tillman, C.</i>	247

PSYCHIAT. QUART.

VOL. XXIV.

JULY, 1950.

Time of Decision. <i>Rogg, S. G.</i>	437
Quo Vadis, Psychiatry? <i>Lowrey, L. G.</i>	448
A Low-cost Psychoanalytic Service. <i>Crowley, R. M.</i>	462
Psychology of the Hypnotist. <i>Pardell, S. S.</i>	483
A Note on Spontaneous Hallucinations During Hypnosis. <i>Schneck, J. M.</i>	492
A Study of Some Psychological Reactions During Pre-Pubescence to the Idea of Death. <i>Caprio, F. S.</i>	495
Brief Shock Therapy. <i>Linn, L., and Rosen, S. R.</i>	506
*The Etiology of Schizophrenia. <i>Shulman, A. J.</i>	515
Transference in Psychotherapy. <i>Lehrman, S. R.</i>	532
A Rorschach Compendium. <i>Piotrowski, Z. A.</i>	543

The Etiology of Schizophrenia.

The fundamental thesis advanced in this paper is that schizophrenia consists of a number of phenomena, defined on a cultural level, and understandable only by concepts unique to the interpersonal level of organization. These concepts are not discussed in detail, and may be found in the writing of such authors as N. Cameron and Sullivan, as well as in current work by sociologists, psychologists and anthropologists.

Genetic findings, used to prove the existence of a specific constitutional predisposition to schizophrenia, are criticized on the basis that the principles of social inheritance, interpersonal relations and social learning are ignored. Biological deviations are explained either as being irrelevant, or as secondary processes resulting from emotional disturbances, or as primary participants acting indirectly in the way they influence the individual's style of life. Biological factors which seem to be more directly related to the schizophrenic process (such as low energy output with a consequent tendency toward withdrawal) are considered to be a universal property of the human organism, normally distributed among the general population. All such characteristics are operative only when there exists a degree of insecurity in childhood, followed by stress later on in life.

It is pointed out that to many observers schizophrenia is not a disease, but a convenient label for a number of phenomena which are continuous with, and merge into, the phenomena of other so-called disease entities. Both on the biological and psychological level there can be found no set of circumstances specific to schizophrenia, except as predicated by the definition of the term.

The action of somatic therapy is explained either on the basis of concomitant interpersonal processes, or on the basis of the influence such treatment has upon a person's psychological life by means of its effect upon universal biological functions. Social and anthropological evidence supporting the suggested view is given, as well as evidence found in clinical experience. The implications of such a theory for research and therapy are discussed.

(Author's abstr.)

PSYCHOANAL. QUART.

VOL. XIX.

JULY, 1950.

The Prepuberty Trauma in Girls. <i>Greenacre, P.</i>	298
Mucous Colitis Associated with Phobias. <i>Sperling, M.</i>	318
Obsessive-Compulsive Symptoms in an Incipient Schizophrenic. <i>Pious, W. L.</i>	327
The Interpretation of the Trauma as a Command. <i>Sperling, O. E.</i>	352
Psychoanalysis and the Social Structure. <i>Parsons, T.</i>	371
The Application of Psychoanalytic Concepts to Social Science. <i>Hartmann, H.</i>	385
Unsatisfactory Results of Psychoanalytic Therapy. <i>Oberndorf, C. P.</i>	393
The Oedipal Legend in Christian Hagiology. <i>Freemantle, A.</i>	408
Repression as a Factor in Learning Theory. <i>Harris, H. I.</i>	410
The Distinction Between Loving and Being Loved. <i>Saul, L. J.</i>	412

PSYCHOL. BULL.

VOL. XLVII.

JULY, 1950.

Some Psychological Problems of Economics. <i>Hayes, S. P., jun.</i>	289
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PSYCHOL. REV.

VOL. LVII.

JULY, 1950.

- Are Theories of Learning Necessary. *Skinner, B. F.* 193
- An Operational Approach to Some Problems in Psychological Measurement. *Comrey, A. L.* 217
- A Note on McGinnies' "Emotionality and Perceptual Defense." *Howes, D. H., and Solomon, R. L.* 229
- Discussion of Howes' and Solomon's Note on "Emotionality and Perceptual Defense." *McGinnies, E.* 235
- Multiple Operation Measurement. *Glaser, R.* 241

PSYCHOMET.

VOL. XIV.

1949.

- A New Coefficient. *Brogden, H. E.* 169
- Further Notes on Differences Between Percentages. *Swineford, F.* 183
- Variation of the Standard Error of Measurement. *Mollinkoff, W. G.* 189
- A New Iterative Method for Correcting Erroneous Communalities Estimates in Factor Analysis. *Wherry, R. J.* 231
- A Simplified Punch Card Method of Determining Sums of Squares and Sums of Products. *Castore, G. F., and Dye, W. S.* 243
- Matrix Representation of Models for the Analysis of Variance and Covariance. *Rubon, P. J.* 259
- r_p and Other Coefficients of Pattern Similarity. *Cattell, R. B.* 279

PSYCHOSOM. MED.

VOL. XII.

JULY-AUGUST, 1950.

- Life Situations, Emotions and Glaucoma. *Ripley, H. S., and Wolff, H. G.* . . . 215
- Measures of Stress Responsivity in Younger and Older Men. *Pincus, G.* . . . 225
- Psychologic Manifestations of the Menstrual Cycle. *Freed, S. C., and Kroger, W. S.* 229
- Psychotic Factors in Psychosomatic Illness. *Appel, J., and Rosen, S. R.* . . . 236
- The Effect of Low Oxygen on Psychologic Performance Tests in Psychoneurotic Patients and Normal Controls. *Waldfogel, S., et al.* 244
- Dermatologic Hypochondriasis. *Zaidens, S. H.* 250
- Recurrent Herpes Simplex. *Blank, H., and Brody, M. W.* 254
- Psychic Stimulation of Prostatic Secretion. *Clark, L. C., jun., and Treichler, P.* 261

QUART. J. EX. PSYCHOL.

VOL. II.

AUGUST, 1950.

- Perceptual Anticipation and Reaction Time. *Poulton, E. C.* 99
- Figured After-effects in Stroboscopic Motion. *Weiskrantz, L.* 113
- A New Phenomenon of Apparent Movement and its After-effect. *Deutsch, J. A.* 119
- The Multiple Criterion Technique of Subjective Appraisal. *Hopkinson, R. G.* 124
- The Influence of an Interpolated Experience upon Recognition. *Davis, D. R., and Sinha, D.* 132

QUART. J. STUD. ALC.

VOL. XI.

SEPTEMBER, 1950.

- *The Effect of Alcohol on Liver Lipids and on Liver and Heart Glycogen. *Forbes, J. C., and Duncan, G. M.* 373
- *Chloride Levels in the Blood of Alcoholic Patients in Relation to the Phenomenon of Craving. *Silkworth, J. D., and Texon, M.* 381
- *Acetaldehyde in Relation to Intoxication by Ethyl Alcohol. *MacLeod, L. D.* 385
- *The Role of Acetaldehyde in the Toxicity of Antabuse and Alcohol. *Lester, D., and Greenberg, L. A.* 391

Alcoholism and the Acute Abdomen. Cohn, R., and Mathewson, C.	396
A Transference Phenomenon in Alcoholics. Brown, C. L.	403
The Washingtonian Movement. Maxwell, M. G.	410
Drinking Patterns of Italians in New Haven. Williams, P. H., and Straus, R.	452
Alcoholism in Ayurveda. Ravi Varma, L. A.	482

The Effect of Alcohol on Liver Lipids and on Liver and Heart Glycogen.

It has been shown, in agreement with Best's findings, that chronic alcoholization does not increase the tendency for the development of nutritional fatty liver when the animals are maintained with a low intake of lipotropic substances. Neither does it seem to accelerate the development of the liver cirrhosis which normally follows a sustained fatty liver. A moderate degree of chronic alcoholization in the rat did not exert any definite effect on the level of glycogen in the liver, but acute alcohol intoxication caused a definite reduction in liver glycogen, except when glucose was administered at the same time. Administration of glucose along with the alcohol in glycogen-depleted animals invariably caused an increase in liver glycogen in spite of the alcohol intoxication. The glycogen concentration of the heart was not apparently influenced by either acute alcohol intoxication or chronic alcoholization. (Authors' abstr.)

Chloride Levels in the Blood of Alcoholic Patients in Relation to the Phenomenon of Craving.

The low salt intake combined with excessive fluid intake in the course of a prolonged alcoholic bout results in a net loss of salt via the urine and, to a lesser extent, in the sweat. The consequent low level of chloride in the blood produces a physiological thirst. The sensation of thirst is normally most delicately regulated to satisfy bodily requirements automatically.

The alcoholic, in the early stages of a drinking bout, drinks as a result of environmental or psychological factors. At this voluntary stage of drinking the blood chlorides are not significantly altered. When the drinking continues to the point of producing a lowered blood chloride level, because of the low salt and excessive water intake combined with excessive chloride loss in urine and sweat, the sensation of thirst evokes an abnormal response. Instead of salt and water the alcoholic continues to take liquor. The stage of uncontrolled drinking has then been reached. The alcoholic takes more whisky and water to replace the loss of water and salt, causing his body fluids to become diluted to hypotonic solutions. This condition, known as water intoxication, may in part account for the muscular cramps frequently noted during drinking bouts. Thus, the alcoholic does not replace his salt, but perhaps satisfies his local pharyngeal thirst sensation by the drinking of more liquor and water. This further exaggerates his net salt loss and perpetuates his craving. The phenomenon of craving for liquor may therefore be viewed as a "perverted physiological craving."

Clinically, the perverted physiological craving for liquor in prolonged alcoholic episodes is promptly corrected by increasing the salt intake in the diet or by the administration of saline parenterally. Within several minutes a dose of 2 gm. of salt in 30 c.c. of water, followed by a glass (200 c.c.) of water, reduces the tremulousness, permits sleep and corrects the physiological craving. (Authors' abstr.)

Acetaldehyde in Relation to Intoxication by Ethyl Alcohol.

It appears that quite high concentrations of acetaldehyde, relatively speaking, can exist in the blood of rats without causing very obvious signs of intoxication. Values of 4 to 6 mgm. per 100 ml. are so much higher than the 100 to 700 micrograms per 100 ml. usually found in the blood of rats suffering from alcohol intoxication that one may safely assume that the signs of intoxication which follow administration of alcohol cannot be attributed to the acetaldehyde alone.

The question whether acetaldehyde makes any important contribution to the degree of alcohol intoxication is less easily answered. Experiments in which alcohol and acetaldehyde have been administered together will be described elsewhere, and suggest some kind of synergistic action between those two agents. In view of what has been said above, it is possible that such effects are the consequence of cerebral anoxia modifying the alcohol intoxication.

The distinction between the effects of temporary anoxia and alcohol intoxication is possibly less clear-cut than might at first appear. In the former the oxygen supply is interrupted, while in the latter, no matter what theory of intoxication or narcosis is preferred, one feels impelled to postulate some interference in carrying on the energy-yielding reactions of cells, which depend ultimately on oxidation for their performance. (Author's abstr.)

The Role of Acetaldehyde in the Toxicity of Tetraethylthiuram Disulfide and Alcohol. With a Method for the Determination of Acetaldehyde in 0.20 ml. of Blood.

The hypothesis that acetaldehyde is responsible for the toxic manifestations observed in man after treatment with tetraethylthiuram disulfide and alcohol is discussed.

Experiments with rats, which exhibit a rise in acetaldehyde after T.E.T.D. and alcohol, have shown that intravenous administration of ferrous chloride and ascorbic acid, either alone or in combination, does not affect the concentration of acetaldehyde in the blood.

Since it has been observed that treatment of human patients with ferrous chloride and ascorbic acid rapidly abolishes or decreases the toxic effect of T.E.T.D. and alcohol, it appears that acetaldehyde is not responsible for the toxicosis.

A method for the determination of acetaldehyde in 0.20 ml. of blood has been described. (Authors' abstr.)

REV. CENTRO PSIQUIAT. NAC. RIO.

VOL. I.	1946.
Are Automatism Harmful or Useful? <i>Taraves Bastos, A.</i>	25
Mongolism and Mongoloid Dystrophy. <i>Rotalinto, C. L.</i>	33
Juvenile Type of Alzheimer's Disease. <i>Elejalde, P., and Lopes, E.</i>	45

REV. FRANÇ. PSYCHOANAL.

VOL. XIII.	1949.
Female Sexuality: II. <i>Bonaparte, M.</i>	161
Contribution to the Psychological Study of Escape Among Prisoners of War, 1939-45. <i>Durandin, G.</i>	228
Intellectual v. Emotional Aspects of the Oedipus Phase. <i>Guex, G.</i>	256
Family Structure and Political Behavior. <i>Marcus, J.</i>	277

REV. NEUROL.

VOL. LXXXII.	APRIL, 1950.
Neurological Manifestations of Acute Porphyria. <i>Bonduelle, M., et al.</i>	233
Two Sterotyped Cases of Tubercular-type Leprosy from the Same House. <i>Thevenard, A., et al.</i>	245

MAY.

Sub-dural Tumours of the Occipital Lobe. <i>Mantin, P., and Kleyntjens, F.</i>	313
Hydrocephalus of Adults. <i>Wertheimer, P., and Dechaume, J.</i>	335

SCHWEIZ. Z. PSYCHOL. ANWEND.

VOL. VIII.	1949.
Biological Psychology, its Scientific Foundations, etc. <i>Brun, R.</i>	1
A Proposed Biological Concept of the Three Psychic Factors. <i>Lechat, F.</i>	20
The Relations Between the Drives of Young and Adult Animals. <i>Meyer-Holzappel, M.</i>	32
The Earliest Psychic Activities of the Embryo. <i>Gerber, A.</i>	61
Concerning the Criticism of Cultural Tendencies in Depth Psychology. <i>Parin, P.</i>	67
Central Disturbances of Language and the Problem of the Localization of Higher Mental Functions in the Brain. <i>Lotmar, F.</i>	135
Reflections Regarding the Psychology of Thinking in the Area of the Mathematical Theory of Sets. <i>Hermann, I.</i>	189
Psychological Comments on Small and Large Numbers. <i>Voellmy, E.</i>	231

Rilke's Representation of Things in the Light of Freud's "Metapsychology."	
<i>Simenauer, E.</i>	277
The Spirit of the Times and Science. <i>Christoffel, H.</i>	295
Psychotherapy and Gymnastics. <i>Braband, M.</i>	300
Remarks about a Psychological Study of Social Workers. <i>Schaelter, M.</i>	310
Concerning the Criticism of Cultural Tendencies in Depth Psychology.	
<i>Parin, P.</i>	317

TRUD. FIZIOL. LAB. PAVLOV.

VOL. XIV.	1947.
The Effect of Cerebellar Extirpation on Conditioned Reflex Activity in Dogs.	
<i>Livshitz, N. N.</i>	11
Dark Adaptation of the Eye under the Influence of an Ultrahigh Frequency Field on the Occipital Region. <i>Livshitz, N. N.</i>	51
On Individual Sensitivity to Ultrahigh Frequency Ideals. <i>Livshitz, N. N.</i>	64
Urinary Bisulfite-binding Substances in Certain Diseases of the C.N.S.	
<i>Borsuk, V. N., and U'rianova, M. G.</i>	90
The Cochlear-pupillary Reflex in Persons with Normal Hearing and in the Shell-shocked. <i>Obratztzora, G. A.</i>	108
The Action of Nicotine and Anabesine on the Vegetative Nervous System.	
<i>Baryshnikov, I. A.</i>	127

1. Biochemistry, Pathology, etc.

Arsenic and Arsenic Compounds in the Central Nervous System. Grzycki, Stanislaw, and Kobusowna, Barbara (Univ. M.C.S., Lublin, Poland). [Ann. Univ. Mariae Curie-Sklodowska, Sect. D4, 19-52 (1949).]

Regardless of the way of administration, As and its compounds are taken up and stored by active mesenchymal cells within their protoplasm. This leads to a damage of nuclear structure, fatty degeneration of the protoplasm and finally to the complete destruction of the cell. As is probably removed through blood vessels and through kidneys. The changes observed in nerve cells are not specific to As, but are secondary in nature, being caused by the cutting off of their normal supply system owing to destruction of the above-mentioned cells. Arsenite, aliphatic As compound (Solarsol), aromatic compounds (Stovarsol, Novarsenobenzol, Neosalvarsan) were used.

I. Z. ROBERTS (Chem. Abstr.).

The Depression of Brain Oxidations. II. Comparative Influence of Pentobarbital upon Dog Cortex, Caudate Nucleus and Hypothalamus. Wilkins, D. S., Featherstone, R. M., Schwidde, J. T., and Broitman, M. (State Univ. of Iowa, Iowa City. [J. Lab. Clin. Med., 35, 411-21 (1950); cf. C. A., 43, 7540i.]

The total *in vitro* O₂ consumption per unit weight by the caudate nucleus of the basal ganglion of dog brain was not significantly greater than that of hypothalamus. Pentobarbital (0.04 per cent.) depressed the O₂ uptake in the order caudate nucleus > cortex > hypothalamus. The relation to each other of the O₂ uptake of these three regions was altered by pentobarbital when plotted against time.

J. D. TAYLOR (Chem. Abstr.).

Amino-acid Mixtures and Mental Function. Rauch, Franz, and Schwobel, Georg (Univ., Hamburg-Eppendorf, Ger.). [Klin. Wochenschr., 27, 30-1 (1949).]

The influence of an amino-acid mixture (containing no glutamic acid) on mental function is identical to that of glutamic acid.

W. T. SMITH, jun. (Chem. Abstr.).

Action of the Antithiamine Factor of Bracken Fern on Peripheral Nerves. Konecni, E. B., and Murali, A. v. (Univ. Bern, Switz.). [Helv. Physiol. Pharmacol. Acta, 7, C44-5 (1949) (in German).]

An extract of *Pteris aquilina* was made with frog Ringer solution. One c.c. (= 0.25 gm. dry fern) was injected into the dorsal lymph sac of the frog. After 4 hours the excitation threshold of the peripheral nerves was 5-10 mv. higher than

in controls, and after 30 hours, 10–25 mv. higher. After 3 days the frogs died. Isolated frog peripheral nerve bundles treated with the diluted extract soon lost all ability to respond to stimuli. Addition of thiamine to the extract inactivates the active principle, and such a mixture has no effect on nerve activity.

L. E. GILSON (Chem. Abstr.).

Physiology of Electric Convulsions. Ammon, Robert, and Ohm, Gerd. [Klin. Wochenschr., **27**, 138–40 (1949).]

In a Warburg apparatus the cholinesterase of serum of patients treated with electric shock shows no cleavage differences. Apparently acetylcholine has nothing to do with electric shock. Since the K content of serum is unchanged (within the experimental error) in cases of electric shock, there must occur no change in the acetylcholine content of the blood.

W. T. SMITH, jun. (Chem. Abstr.).

Motor, Respiratory, Cardiovascular and Blood-sugar Changes during Electric Shock. Piette, Yves (Lab. Hydrol. et biol. exptl. Ostende, Belg.). [Ann. soc. roy. sci. med. et nat. Bruxelles, **3**, 5–71 (1950).]

d-Tubocurarine-HCl (I), RP 3697 (II), phenobarbital (III) and pentobarbital-Na (IV) completely inhibited the convulsions which otherwise resulted when 60–80 v. was applied for 0.1–0.2 sec. to electrodes between the eyes and ears of rabbits. Myanesin (V) raised the convulsive threshold, and diphenylhydantoin (VI) suppressed the tonic (early) phase of the convulsions. In the rabbit the convulsions were accompanied by apnea, which was suppressed by (III) and (VI). In the rabbit bilateral adrenalectomy suppressed the brief hypotensive phase which ordinarily followed electric shock, and reduced the amplitude and duration of the prolonged hypertensive reaction which normally followed the hypotension. (I), (II) and (V) did not suppress the hypertensive phase in the rabbit, but (I) and (II) sharply diminished or abolished the hypotensive stage. (III) and (IV) suppressed and (VI) strongly reduced the hypertensive phase. Atropine, adrenaline and morphine suppressed the hypotensive phase in the rabbit. Dihydroergotamine (VII) suppressed the hypertensive phase and replaced it with a marked hypotension and bradycardia. Acetylcholine did not suppress the hypertensive phase, but kept blood pressure during it below the initial level of arterial pressure. Chloralose did not affect the pressure variations following electric shock. Nicotinic acid, in doses sufficient to abolish the motor disturbances following shock, suppressed the hypertensive phase, which was replaced by hypertension. The pressure at the peripheral end of the common carotid artery of the rabbit, or the external carotid of the dog, showed a short slight rise immediately after shock, even in animals prepared with (III) or (VII). In man, electric shock was followed by hyperglycemia unless the subject was first given pentothal, in which case a slight hypoglycemia took its place. Reflex vasodilation due to shock-induced vasoconstriction of cerebral vessels is largely overridden by hypertension due to asphyxia and sympathetic activity. Use of curare alone during electric shock is not justified; the addition of pentothal is indispensable. Barbiturates alone can prevent traumatic complications and the hypertensive reaction of shock. In man, O given before and immediately after shock attenuates the hypertensive phase.

MARSHALL E. DEUTSCH (Chem. Abstr.).

Brain Lesions in the Rat Produced by Large Doses of Desoxycorticosterone Acetate. Faribault, Claude, and Haour, Pierre (Univ. Montreal, Can.). [Rev. can. biol., **9**, 99, (1950).]

Prolonged treatment of the rat with desoxycorticosterone acetate would seem to produce selective vascular lesions in the encephalon, accompanied by higher permeability of these vessels and an increase in the formation of cerebrospinal fluid.

A. PAPINEAU-COUTURE (Chem. Abstr.).

Parabiotic Nature of Central Nerve Control and the Teachings of I. P. Pavlov. Mag-nitskii, A. N. [Uspekhi Sovremennoi Biol., **26**, 875–92 (1948).]

A review with emphasis on optimum and pessimum effects in the relations between glycogen and lactic acid in muscles, in the range between narcosis and the pain threshold.

JULIAN F. SMITH (Chem. Abstr.).

Sphingomyelin and the Ether-insoluble Glycerophosphatide of the Brain. Rennkamp, Friedrich (Univ., Cologne, Ger.). [*Z. physiol. Chem.*, **284**, 215-28 (1949).]

Pure glycerol-free sphingomyelin with the correct P:N ratio from brain was hydrolyzed with alc.-HCl. Among the hydrolytic products, fatty acids occurred in the theoretical amount. About 70 per cent of the free sphingosine was found. Free H_3PO_4 and free choline were not found. The principal fatty acids were stearic acid (46 per cent.) and nervonic and lignoceric acids (34 per cent together). Other acids found were: Palmitic 2 per cent., arachidic 2 per cent., behenic 6 per cent., a hexacosenic 10 per cent. The palmitic acid cannot be an essential component of the brain sphingomyelin. In the glycerophosphatide it accounted for 81 per cent. of the entire fatty acids. Among the partial hydrolysis products sphingosine-phosphoric acid-choline ester was found in small amounts and apparently impure. The monoethylsphingosine chloride was identical with a preparation obtained from cerebroside. The combination of the phosphoric acid must, in both the sphingomyelin and cerebroside, take place through the same OH group of the sphingosine. The investigation confirms the structural formula for sphingomyelin proposed by Levene (*C. A.*, **10**, 1844). FELIX SAUNDERS (Chem. Abstr.).

The Effect of Glycerophosphocholine on the Action of Cholinesterase. Stern, P., and Režek, A. (Univ. Zagreb.). [*Archiv. Kem.*, **20**, 97-100 (1948) in German.]

Glycerophosphocholine (I) is one of the ingredients of choline reserve, hence contains a quaternary N atom and thus biologically belongs to the same series with choline and aneurine, while pharmacologically it is an inhibitor of the eserine type. Its inhibiting effect on cholinesterase of the serum is evident only when present there in large concentrations, as is also true of choline and aneurine (*cf.* Krvavic, *Veterinar. Archiv (Zagreb)*, **18**, 261 (1948); Sullmann, *C. A.*, **40**, 5079⁴). Stern and Režek studied the effect of (I) on cholinesterase of the serum in comparison with the acetylcholine (II) action on the same enzyme. In parallel experiments the physiological properties of the two bases were compared. In accordance with Arnold (*C. A.*, **34**, 2789⁴), (I) is analogous to (II) and acts as a direct choline donor. The depression of the amplitude of toad heart-muscle contractions by (I) was somewhat less pronounced than by (II). The mode of action of (I) was spontaneous, suggesting hydrolysis of the choline group, as is the case with (II). (I) is a vagus stimulant of the same order of potency as the base (II). The above experiments were repeated using 2 mgm. of (I) in the perfusion fluid, and defibrinated blood instead of serum. The action of (I) was compared with that of trichloroacetic acid (III). The cholinesterase of defibrinated blood was found unaffected by the low concentrations of (I) after 5 second interaction (the hydrolysis of (I) present in concentration of 10^{-4} proceeded unhampered). The enzyme was almost completely inhibited by (III). Comparison of (I) and (II) in their action against eserine salicylate (IV) was carried out with the muscle of a leech according to Minz (*C. A.*, **27**, 776). As in the case of heart muscle, (I) used alone was ineffective in concentrations of 10^{-6} up to 10^{-5} , but inhibitive in concentration of 10^{-5} . Its potency at this concentration was equivalent to that of (II) at concentration of 10^{-7} , which was also acting on the leech muscle. This parallelism of inhibition was evident throughout the duration of the experiment, except for the prelethal stage. At that stage the difference between (I) and (II) was demonstrated with regard to leech muscle sensitization. This was done by addition of (IV) to the perfusion fluid in a concentration of 10^{-5} . The sensitization produced by (IV) could not be inverted by addition of (I) in concentration of $<10^{-4}$ even after 15 minutes' interaction. Increasing the amount to 2 mgm. of (I) still did not produce the inversion effect after an interval of 15 minutes, while (II) at a concentration of 10^{-7} gave the inversion after the same time interval. When present in higher concentrations (2 mgm.) (II) as well as (I) no longer sensitizes the muscle (no amplitude rise after 15 minutes). Hence this difference smooths out for larger concentrations of (I) and (II). From its behaviour at lower concentrations (10^{-5} - 10^{-4}), especially with regard to effect against eserine, it was concluded that under conditions of *in vitro* experiments the action of (I) is independent of that of cholinesterase, and that (IV) does not participate in the mechanism of degradation of (I). This leads to the hypothesis that (I) must be a direct choline donor. The mechanism of choline cleavage from the molecule of (I) could not be ascertained. The facts that (I) is stable in aqueous solution and that the above cleavage proceeds slowly, when the serum medium is

used, as well as the fact that not all the steps of degradation, nor all the intermediate products formed, are known at present, all speak in favour of an enzyme catalysis. The fact that (I) when present in minimal quantity ($<10^{-5}$), does not inhibit cholinesterase, suggests that this enzyme is its activator, as it is in the case of (II). However, other catalysts may play a role alone or in conjunction with cholinesterase. *In vivo* experiments on blood pressure of rabbits under urethan showed that intravenous doses of 0.5 and 1 mgm. of (I) lowered the blood pressure considerably after an interval of 30 seconds. A larger dose gave non-linear increase in the effect. Normalization was rapid at both doses. With some animals return to normal was followed by a slight rise. Comparison with (II) showed that the effect was about equal in intensity at a dose of 0.5 mgm., but at the dose of 1 mgm. (I) is more potent than (II). Atropine sulfate (5 mgm.) with simultaneous exclusion of the parasympathetic innervation of the blood vessels showed that at a dose of 1 mgm. the blood pressure decrease caused by (I) is reversed to the same extent as in the case of (II). These experiments demonstrate the cholinergic effect of (I) and its much weaker potency (1/1000) than that of (II), which confirms the results of Arnold (*loc. cit.*). In experiments on blood sugar in rabbits, intravenous injection of (I) in doses of 2-3 mgm. produced a 10 per cent. increase. The effect was very brief (15 minutes), and was followed by a rapid return to normal.

C. S. SHAPIRO (Chem. Abstr.).

The True Cholinesterase Activity of the Brains of Physostigmine-poisoned Rats. Kalsbeek, F., and Cohen, J. A. (Natl. Defense Research Council T.N.O., Leyden, Netherlands). [*Biochim. et Biophys. Acta*, **4**, 559-65 (1950) (*in English*).]

Cholinesterase activities were determined on the brains of normal rats, physostigmine-poisoned rats during convulsions and attacks, and after clinical recovery. Essentially, activity after clinical recovery was significantly lower than normal, but also markedly higher than during the malady.

ERIC ELLENBOGEN (Chem. Abstr.).

Acetylcholine-like Action of a Product Formed by an Acetylating Enzyme System Derived from Brain. Middleton, S., and Middleton, H. H. [*Proc. Soc. Exptl. Biol. Med.*, **71**, 523-6 (1949).]

The pharmacological properties of an enzymically formed product described by Nachmansohn *et al.* (*C. A.*, **43**, 9092e) were studied. This product, obtained in the choline acetylating system of brain extract, is distinctly different from acetylcholine, but has an acetylcholine-like action on frog rectus abdominis muscle. It decreases the arterial blood pressure of cats and the amplitude of the beat of the isolated frog heart in the same way as acetylcholine, and these two actions are suppressed by atropine.

L. E. GILSON (Chem. Abstr.).

Changes of Acid-base and Electrolytic Equilibria in Human Cerebrospinal Fluid during Spinal Anaesthesia. Forni, Paolo (Univ. Pavia, Italy). [*Med. sper.*, **18**, 75-88 (1947).]

Ten cases of anesthesia with 150 mgm. procaine were investigated. In 5 cases of anesthesia the pH and the alkali reserve decreased with electrolytic displacement towards the acid side along with an increase of Mg ions. In 5 cases of anesthesia after the Daniel test only the alkali reserve decreased, while Ca ions increased in place of Mg.

C. SCANDURA (Chem. Abstr.).

A Direct Detection of Protective Proteinases in the Cerebrospinal Fluid. Abderhalden, Rudolf, and Elsaesser, Karl Heinz (Univ. Halle, Ger.). [*Fermentforsch.*, **17**, 178-83 (1943); *cf. C. A.*, **42**, 3447b.].

Instead of dry preparation, 2.5 or 3.0 ml. of the original cerebrospinal fluid (I) was used. After addition of the proper tissue substrates it was incubated for 6 hours, then filtered and the filtrate was tested for ninhydrin reaction. Comparison of the clinical results obtained with (I) and with urine preparation indicated that the former was diagnostically more reliable.

L. W. (Chem. Abstr.).

The Influence of Calcium, Potassium and Magnesium Ions in Cerebrospinal Fluid on Vasomotor System. Leusen, I. (Univ. Ghent, Belg.). [*J. Physiol. (London)*, **110**, 319-29 (1950).]

Perfusion of cerebral ventricles of bilaterally vagotomized dogs (with isolated carotid sinuses) resulted in depression of blood pressure (I) and vasomotor reflexes (II) with an excess of CaCl_2 in the perfusate, and rise in arterial (I) and enhanced (II) with a lowered CaCl_2 . Excess of K in perfusate raised (I) and enhanced (II); K-free perfusate had no effect on either (I) or (II). Excess Mg depressed (I) and (II); Mg-free solution had little effect. Increased vasomotor tone in peripheral vessels and in splanchnic areas and increased adrenaline secretion accompanied rise in (I) with excess K and decreased Mg.

MORRIS ROCKSTEIN (Chem. Abstr.).

Preparation of Crystalline Protective Proteinases from the Cerebrospinal Fluid. Abderhalden, Rudolf, and Elsaesser, Karl H. (Univ., Halle, Ger.). [*Fermentforsch.*, **17**, 213-16 (1943); cf *C. A.*, **42**, 3447b.].

Cerebrospinal fluid obtained from paralytic patients and patients with Huntington's chorea was dialyzed at room temperature for 48 hours against tap-water. After centrifugation the supernatant was concentrated in vacuum to 0.1 of the original volume. Upon cooling overnight monoclinic crystals were formed, which possessed a specific action only on cerebrum, ganglion-base and the mid-brain.

L. WEIL (Chem. Abstr.).

Gonadotropin in Spinal Fluid in a Case of Twin Pregnancy. Criticism of Spinal Fluid Test for Diagnosis of Hydatidiform Mole. Brody, Henry, and Horowitz, Edward A. (Beth Israel Hosp., New York, N.Y.). [*Am. J. Obstet. Gynecol.*, **59**, 685-8 (1950).]

A case of twin pregnancy is presented in which the spinal fluid contained gonadotropic hormone. No basis is found for the contention that the demonstration of gonadotropic hormone in the spinal fluid is diagnostic of hydatid mole or chorion-epithelioma.

RUTH BERGGREN (Chem. Abstr.).

2. Pharmacology and Treatment.

Medical Therapy of Epilepsy. Carter, Sidney, and Merritt, H. Houston (Columbia Univ.). [*J. Lancet*, **70**, 103-6 (1950).]

The compounds 5-methyl-5-phenylhydantoin (I), 5,5-diphenylhydantoin, 5-thienyl-5-phenylhydantoin, and phenylacetylurea had anticonvulsant activity. 5-Isopropoxymethyl-5-phenylhydantoin and ethyl phenyl sulfone were not effective. Only (I) was more effective than 5,5-diphenylhydantoin or phenobarbital, being effective in 73 per cent. of the cases. A high percentage of allergic skin reactions occurred after the use of (I).

E. K. WEISBURGER (Chem. Abstr.).

Action of d-Tubocurarine Chloride on the Central Nervous System of the Cat. Salama, S., and Wright, Samson (Middlesex Hosp. Med. School, London). [*Brit. J. Pharmacol.*, **5**, 49-61 (1950).]

The effect of d-tubocurarine (I) on the central nervous system was studied by intraventricular, intracisternal and intrathecal injections in cats under chloralose anesthesia, and in decerebrate preparations (I) applied directly to the central nervous system had an excitatory action. Small doses directly excited the vasomotor, respiratory, cardiac and other autonomic centers, especially those innervating the salivary glands and bronchi. They produced heightened reflex excitability of the spinal cord and later generalized convulsions, mainly as the result of stimulation of the cells of origin of the facilitatory pathways in the brain. Intracisternal or intraventricular injections produced complex changes in the eyes and muscles of the head owing to an action on centers in the midbrain and pons.

RICHARD F. RILEY (Chem. Abstr.).

Comparison of the Effect of Ether and Curare on the Neuromuscular Transmission, Investigated by Means of Prostigmine. Naess, Knut (Univ., Oslo, Norway). [*Acta Physiol. Scand.*, **20**, 117-24 (1950).]

The effect of ether and curare in the motor endplate has been studied by means of prostigmine. Following injection of prostigmine the inhibition of neuromuscular transmission caused by ether and curare is affected differently, which leads to the conclusion that the inhibition exerted in the endplate must also be by essentially different mechanisms. The ether effect is explained partly by a decreased sensitivity of the muscle cells to acetylcholine. The inhibitory effect of ether and prostigmine is synergistic and rapidly disappears on termination of the anesthesia, while curare and prostigmine neutralize the inhibition produced by each substance separately. It is assumed that ether not only suppresses the acetylcholine sensitivity, but also reduces the production of acetylcholine in the endplate.

S. MORGULIS (Chem. Abstr.).

Effect of Tridione (3,3,5-trimethyl-2,4-oxazolidinedione) on the Oxygen Uptake of Mouse Brain. Taylor, J. D., Richards, R. K., Everett, G. M., and Bercher, Elizabeth L. (Abbott Research Labs., North Chicago). [*J. Pharmacol. Exptl. Therap.*, **98**, No. 4, Pt. 1, 392-9 (1950).]

The effect of 0.035, 0.07 and 0.14 M tridione as an inhibitor of O uptake of mouse brain slices with glucose, lactate, pyruvate, succinate, glutamate, citrate and acetate was studied. At the lowest concentration inhibition occurred only with glucose. At the higher concentrations inhibition was present with all substrates; least with succinate. The inhibition with glucose substrate could be overcome by washing or by addition of p-phenylenediamine or methylene blue, but not by addition of ascorbic acid, glutathione, cysteine, adenosinetriphosphate, or cytochrome c. Brain slices from mice previously injected with large doses of tridione showed decreased O uptake in presence of glucose.

L. E. GILSON (Chem. Abstr.).

Effect of Convulsant and Anticonvulsant Agents on Activity of Oxalacetic and Pyruvic Carboxylases. Torda, Clara, and Wolff, Harold G. (Cornell Univ. Med. Coll., New York, N.Y.) [*J. Pharmacol. Exptl. Therap.*, **98**, No. 4, Pt. 1, 358-65 (1950); cf. *C. A.*, **43**, 5865f.].

The enzymes were prepared by known methods from musk melon pulp and seed and pigeon liver. Their activity was inhibited more or less by the convulsive agents, acetylcholine, caffeine, camphor, cocaine, dichlorodiphenyltrichloroethane, Me salicylate, metrazole, picrotoxin, scilliroside, and strychnine; unaffected by tridione and choline; and slightly increased by the anticonvulsive agents, phenobarbital, hydantoin, methylphenylethylhydantoin, and Na phenylhydantoinate.

L. E. GILSON (Chem. Abstr.).

Comparative Action of Eserine and Pilocarpine on the Cholinesterases of Serum and Brain. Vincent, D., and Lagreu, R. (Univ. Toulouse, France). [*Compt. rend. soc. biol.*, **143**, 1091-3 (1949).]

Eserine has a marked inhibiting action on the cholinesterases of diluted horse serum and diluted sheep brain (grey matter) homogenate. Pilocarpine has about 10^{-5} the inhibiting action of eserine.

L. E. GILSON (Chem. Abstr.).

